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I. STATUS OF CLAIMS

Claims 1-29 are pending.

Claims 13-24 stand rejected under 35 U.S.C. § 101 as being directed to non-statutory subject matter. *See Examiner's Office action,* p. 4 (21 August 2007).

Claims 13-24 stand rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the enablement requirement. *See Examiner's Office action*, p. 5 (21 August 2007).

Claims 25 and 28 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. *See Examiner's Office action*, p. 6 (21 August 2007).

Claims 1, 3-10, 13, and 15-22 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al. See Examiner's Office action*, p. 6 (21 August 2007).

Claims 2 and 14 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* and in further view of "The Design of an Acquisitional Query Processor For Sensor networks" by Samuel Madden *et al. See Examiner's Office action*, pp. 8-9 (21 August 2007).

Claims 11, 12, 23, and 24 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/01611651) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* and in further view of Regli *et al.* (2005/0141706). *See Examiner's Office action*, p. 9 (21 August 2007).

Claims 25. 26, and 29 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mulgund *et al.* (2002/01611651) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et al. See Examiner's Office action*, pp. 10-11 (21 August 2007).

Claims 27 and 28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Mulgund *et al.* (2002/01611651) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* in view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et al.* and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden *et al.* *See Examiner's Office action*, pp. 10-11 (21 August 2007).

II. ISSUES TO BE REVIEWED

The issues in this response relate to whether the art of record establishes a *prima facie* case of the unpatentability of Applicant's Claims 1-29. For reasons set forth elsewhere herein, Applicant respectfully asserts that the art of record does not establish a *prima facie* case of the unpatentability of any pending claim. Accordingly, Applicant respectfully requests that Examiner hold all pending Claims 1-29 allowable for at least the reasons described herein, and issue a Notice of Allowability on same.

III. ARGUMENT: ART OF RECORD DOES NOT ESTABLISH *PRIMA FACIE* CASE OF UNPATENTABILITY IN VIEW OF CITED ART OF RECORD

The Office action states, "Claims 13-24 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter." *See Examiner's Office action,* p. 4 (21 August 2007).

Further, the Office action states, "Claims 13-24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement." *See Examiner's Office action*, p. 5 (21 August 2007).

Further, the Office action states, "Claims 25 and 28 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention." *See Examiner's Office action*, p. 6 (21 August 2007).

Further, the Office action states, "Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al. See Examiner's Office action*, p. 6
(21 August 2007).

Further, the Office action states, "Claims 2 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* (hereinafter Madden Ref.1) and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden *et al.* (hereinafter Madden Ref.2). *See Examiner's Office action*, pp. 8-9 (21 August 2007)."

Further, the Office action states, "Claims 11, 12, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/01611651) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* and in further view of Regli *et al.* (2005/0141706). *See Examiner's Office action*, p. 9 (21 August 2007).

Further, the Office action states, "Claims 25, 26, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/01611651) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et al. See Examiner's Office action*, pp. 10-11 (21 August 2007).

Still further, the Office action states, "Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/01611651) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* (herein after Madden Ref. 1) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* in view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et al.* and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden *et al.* (hereinafter Madden Ref. 2). *See Examiner's Office action*, pp. 10-11 (21 August 2007).

In response, Applicant respectfully asserts herein that, under the MPEP and legal standards for patentability as set forth below, the art of record does not establish a *prima facie* case of the unpatentability of Applicant's claims at issue. Specifically, Applicant respectfully

shows below that the art of record does not show or suggest the recitations of Applicant's claims at issue, and hence fails to establish a *prima facie* case of unpatentability. Accordingly, Applicant respectfully requests that the Examiner withdraw his rejections and hold all claims to be allowable over the art of record.

A. MPEP Standards for Patentability[1]

The MPEP states as follows: "the examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability. If that burden is met, the burden of coming forward with evidence or argument shifts to the applicant... If examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent." *MPEP* § 2107 (citing *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992)); *In Re Glaug* 283 F.3d 1335, 62 USPQ2d 1151 (Fed. Cir. 2002) ("During patent examination the PTO bears the initial burden of presenting a *prima facie* case of unpatentability. *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992); *In re Piasecki*, 745 F.2d 1468, 1472, 223 U.S.P.Q. 785, 788 (Fed. Cir. 1984). If the PTO fails to meet this burden, then the applicant is entitled to the patent."). Accordingly, unless and until an examiner presents evidence establishing *prima facie* unpatentability, an applicant is entitled to a patent on all claims presented for examination.

1. MPEP Standards for Determining Anticipation

An examiner bears the initial burden of factually supporting any *prima facie* conclusion of anticipation. *Ex Parte Skinner*, 2 U.S.P.Q.2d 1788, 1788-89 (B.P.A.I. 1986); *In Re King*, 801 F.2d 1324, 231 U.S.P.Q. (BNA) 136 (Fed. Cir. 1986); *MPEP* § 2107 (citing *In re Oetiker*, 977 F.2d 1443, 1445, 24 U.S.P.Q.2d 1443, 1444 (Fed. Cir. 1992) ("[T]he examiner bears the initial burden, on review of the prior art or on any other ground, of presenting a *prima facie* case of unpatentability....")). Failure of an examiner to meet this burden entitles an applicant to a patent.

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[1] Applicant is aware that Examiner is familiar with the MPEP standards. Applicant is merely setting forth the MPEP standards to serve as a framework for Applicant's arguments following and to ensure a complete written record is established. Should Examiner disagree with Applicant's characterization of the MPEP standards, Applicant respectfully requests correction.

Id. ("[i]f examination at the initial stage does not produce a *prima facie* case of unpatentability, then without more the applicant is entitled to grant of the patent").

The MPEP indicates that in order for an examiner to establish a *prima facie* case of anticipation of an applicant's claim, the examiner must first interpret the claim,[2] and thereafter show that the cited prior art discloses the same elements, in the same arrangement, as the elements of the claim which the examiner asserts is anticipated. More specifically, the MPEP states that "[a] claim is anticipated *only if each and every element as set forth in the claim is found*, either expressly or inherently described, in a single prior art reference. . . . The identical invention must be shown in as complete detail as is contained in the . . . claim. . . . The elements must be arranged as required by the claim . . . .". *MPEP* § 2131 (emphasis added). Consequently, under the guidelines of the MPEP set forth above, if there is *any* substantial difference between the prior art cited by an examiner and an applicant's claim which the examiner asserts is rendered anticipated by the prior art, the prior art does NOT establish a *prima facie* case of anticipation and, barring other rejections, the applicant is entitled to a patent on such claim.

2. MPEP Standards for Determining Obviousness

"[T]he examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness."[3] *MPEP* § 2142. The MPEP indicates that in order for an examiner to establish a *prima facie* case that an invention, as defined by a claim at issue, is obvious, the examiner must (1) interpret the claim at issue; (2) define one or more prior art reference components relevant to the claim at issue; (3) ascertain the differences between the one or more prior art reference components and the elements of the claim at issue; and (4) adduce objective

[2] With respect to interpreting a claim at issue, the MPEP directs that, during examination -- as opposed to subsequent to issue -- such claim be interpreted as broadly as the claim terms would reasonably allow, in light of the specification, when read by one skilled in the art with which the claimed invention is most closely connected. *MPEP* § 2111.

[3] An invention, as embodied in the claims, is rendered obvious if an examiner concludes that although the claimed invention is not identically disclosed or described in a reference, the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *MPEP* § 2141 (citing 35 U.S.C. § 103).

evidence which establishes, under a preponderance of the evidence standard, a teaching to modify the teachings of the prior art reference components such that the prior art reference components can be used to construct a device substantially equivalent to the claim at issue. This last step generally encompasses two sub-steps: (1) adducement of objective evidence teaching how to modify the prior art components to achieve the individual elements of the claim at issue; and (2) adducement of objective evidence teaching how to combine the modified individual components such that the claim at issue, as a whole, is achieved. *MPEP* § 2141; *MPEP* § 2143. Each of these forgoing elements is further defined within the MPEP. *Id.*

This requirement has been explained recently by the Supreme Court in *KSR v. Teleflex, 550 U.S. _____; 127 S. Ct. 1727 (2007)* which noted that such a rejection requires "some articulated reasoning ... to support the legal conclusion of obviousness." As stated by the Court, obviousness can be established where "there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, ***this analysis should be made explicit.***" (*emphasis added*) See In re Kahn, 441 F. 3d 977, 988 (CA Fed. 2006) ('[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.')." *KSR v. Teleflex, 550 U.S. _____; 127 S. Ct. 1727 at 1741.*

As further described by the Court ***"[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.*** Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known." *KSR v. Teleflex, 550 U.S. _____; 127 S. Ct. 1727 at 1741.*

a) Interpreting a Claim at Issue

With respect to interpreting a claim at issue, the MPEP directs that, during examination -- as opposed to subsequent to issue -- such claim be interpreted as broadly as the claim terms would reasonably allow when read by one skilled in the art with which the claimed invention is

most closely connected. In practice, this is achieved by giving each of the terms in the claim the "plain meaning" of the terms as such would be understood by those having ordinary skill in the art, and if portions of the claim have no "plain meaning" within the art, or are ambiguous as used in a claim, then the examiner is to consult the specification for clarification. *MPEP* § 2111.

b) Definition of One or More Prior Art Reference Components Relevant to the Claim at Issue

Once the claim at issue has been properly interpreted, the next step is the definition of one or more prior art reference components (*e.g.*, electrical, mechanical, or other components set forth in a prior art reference) relevant to the properly interpreted claim at issue. With respect to the definition of one or more prior art reference components relevant to the claim at issue, the MPEP defines three proper sources of such prior art reference components, with the further requirement that each such source must have been extant at the time of invention to be considered relevant. These three sources are as follows: patents as defined by 35 U.S.C. § 102, printed publications as defined by 35 U.S.C. § 102, and information (*e.g.*, scientific principles) deemed to be "well known in the art"[4] as defined under 35 U.S.C. § 102. *MPEP* § 2141; *MPEP* § 2144.

c) Ascertainment of Differences between Prior Art Reference Components and Claim at Issue; Teaching to Modify and/or Combine Prior Art Reference Components to Remedy Those Differences in Order to Achieve Recitations of Claim at Issue

With one or more prior art components so defined and drawn from the proper prior art sources, the differences between the one or more prior art reference components and the elements of the claim at issue are to be ascertained. Thereafter, in order to establish a case of *prima facie*

[4] The fact that information deemed to be "well known in the art" can serve as a proper source of prior art reference components seems to open the door to subjectivity, but such is not the case. As a remedy to this potential problem, *MPEP* § 2144.03 states that if an examiner asserts that his position is derived from and/or is supported by a teaching or suggestion that is alleged to have been "well known in the art," and that if an applicant traverses such an assertion (that something was "well known within the art"), the examiner must cite a reference in support of his or her position. The same MPEP section also states that when a rejection is based on facts within the personal knowledge of an examiner, the data should be stated as specifically as possible, and the facts must be supported, when called for by the applicant, by an affidavit from the examiner. Such an affidavit is subject to contradiction or explanation by the affidavits of the applicant and other persons. *Id.* Thus, all sources of prior art reference components must be objectively verifiable.

obviousness, an examiner must set forth a rationale, supported by objective evidence[5] sufficient to demonstrate under a preponderance of the evidence standard, that in the prior art extant at the time of invention there was a teaching to modify and/or combine the one or more prior art reference components to construct a device practicably equivalent to the claim at issue.

The preferable evidence relied upon is an express teaching to modify/combine within the properly defined objectively verifiable sources of prior art. In the absence of such express teaching, an examiner may attempt to establish a rationale to support a finding of such teaching reasoned from, or based upon, express teachings taken from the defined proper sources of such evidence (*i.e.*, properly defined objectively verifiable sources of prior art). *MPEP* § 2144; *In re Dembiczak*, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999).

The MPEP recognizes the pitfalls associated with the tendency to subconsciously use impermissible "hindsight" when an examiner attempts to establish such a rationale. The MPEP has set forth at least two rules to ensure against the likelihood of such impermissible use of hindsight. The first rule is that:

> under 35 U.S.C. 103, the examiner must step backward in time and into the shoes worn by the hypothetical "person of ordinary skill in the art" when the invention was unknown and just before it was made. In view of all factual information,[6] the examiner must then make a determination whether the claimed invention "as a whole" would have been obvious at that time to that person. Knowledge of an Applicant's disclosure must be put aside in reaching this determination, yet kept in mind in order to determine the "differences," conduct the search, and evaluate the "subject matter as a whole" of the invention. The tendency to resort to "hindsight" based upon an Applicant's disclosure is often difficult to avoid due to the very nature of the examination process. However, impermissible hindsight must be avoided and the legal conclusion must be reached on the basis of the facts gleaned from the prior art.

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5 The proper sources of the objective evidence supporting the rationale are the defined proper sources of prior art reference components, discussed above, with the addition of factually similar legal precedent. *MPEP* § 2144.

6 "Factual information" is information actually existing or occurring, as distinguished from mere supposition or opinion. *Black's Law Dictionary* 532 (5th ed. 1979).

MPEP § 2142 (emphasis added). Thus, if the only objective evidence of such teaching to modify and/or combine prior art reference components is an applicant's disclosure, no evidence of such teaching exists.[7]

The second rule is that if an examiner attempts to rely on some advantage or expected beneficial result that would have been produced by a modification and/or combination of the prior art reference components as evidence to support a rationale to establish such teachings to modify and/or combine prior art reference components, the MPEP requires that such advantage or expected beneficial result be objectively verifiable teachings present in the acceptable sources of prior art (or drawn from a convincing line of reasoning based on objectively verifiable established scientific principles or teachings). *MPEP* § 2144. Thus, as a guide to avoid the use of impermissible hindsight, these rules from the MPEP make clear that absent some objective evidence, sufficient to persuade under a preponderance of the evidence standard, no teaching of such modification and/or combination exists.[8]

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[7] An applicant may argue that an examiner's conclusion of obviousness is based on improper hindsight reasoning. However, "[a]ny judgment on obviousness is in a sense necessarily a reconstruction based on hindsight reasoning, but so long as it takes into account only knowledge which was within the level of ordinary skill in the art at the time the claimed invention was made and does not include knowledge gleaned only from applicant's disclosure, such a reconstruction is proper." *MPEP* § 2145(X)(A) (emphasis added).

[8] *In Re Sang Su Lee* 277 F.3d 1338 (Fed. Cir. 2002) ("When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness.") *See, e.g., McGinley v. Franklin Sports, Inc.*, 262 F.3d 1339, 1351-52, 60 U.S.P.Q.2d 1001, 1008 (Fed. Cir. 2001) ("the central question is whether there is reason to combine [the] references," a question of fact drawing on the *Graham* factors). *"The factual inquiry whether to combine references must be thorough and searching." Id. It must be based on objective evidence of record. This precedent has been reinforced in myriad decisions, and cannot be dispensed with. See, e.g., Brown & Williamson Tobacco Corp. v. Philip Morris Inc.*, 229 F.3d 1120, 1124-25, 56 U.S.P.Q.2d 1456, 1459 (Fed. Cir. 2000) ("a showing of a suggestion, teaching, or motivation to combine the prior art references is an 'essential component of an obviousness holding'") (quoting *C.R. Bard, Inc., v. M3 Systems, Inc.*, 157 F.3d 1340, 1352, 48 U.S.P.Q.2d 1225, 1232 (Fed. Cir. 1998)); *In re Dembiczak*, 175 F.3d 994, 999, 50 U.S.P.Q.2d 1614, 1617 (Fed. Cir. 1999) ("Our case law makes clear that the best defense against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references."); *In re Dance*, 160 F.3d 1339, 1343, 48 U.S.P.Q.2d 1635, 1637 (Fed. Cir. 1998) (there must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant); *In re Fine*, 837 F.2d 1071, 1075, 5 U.S.P.Q.2d 1596, 1600 (Fed. Cir. 1988) ("'teachings of references can be combined only if there is some suggestion or incentive to do so.'") (emphasis in original) (quoting *ACS Hosp. Sys., Inc. v. Montefiore Hosp.*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984)). The need for specificity pervades this authority. *See, e.g., In re Kotzab*, 217 F.3d 1365, 1371, 55 U.S.P.Q.2d 1313, 1317 (Fed. Cir. 2000) ("particular findings must be made as to the reason the skilled artisan, with no knowledge of the claimed invention, would have selected these components for combination in the manner claimed"); *In re Rouffet*, 149 F.3d 1350, 1359, 47 U.S.P.Q.2d 1453, 1457-58 (Fed. Cir. 1998) ("even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill, that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the

B. Technical Material Cited by Examiner Does Not Show/Suggest Recitations of Independent Claim 1 and Dependent Claims 2-12, Independent Claim 25, Independent Claim 26 and Dependent Claims 27-29 as Presented Herein; Notice of Allowability of Same Respectfully Requested

1. Independent Claim 1

Claim 1 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Mulgund et al. in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al. Applicant respectfully traverses the rejection of claim 1.

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action at page 7, paragraph 12, recites:

> As to claim 1, Mulgund shows:
> transmitting at least a part of one or more mote-addressed content indexes of a first set of motes [visiting a node and retrieving the information stored at the node] (paragraphs [0025] and [0062]), wherein the terms "node" and "mote" are interpreted to have the same meaning of small embedded platform that has one or more sensors (paragraph [0026]) and therefore these terms are used here interchangeably.
> Mulgund does not explicitly show that at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes is transmitted.
> Madden shows transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes [a collection phase, where

art would have been motivated to select the references and to combine them to render the claimed invention obvious.")).

the aggregate value are continually routed up from children to parents] (abstract, section 1.1 paragraph 2, section 4 and 4.1 paragraphs 1-2).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund by transmitting at least a part of an aggregate of one of more mote-addressed content indexes in order to lower the number of message transmissions, latency, and power consumption that the server-based approach (as taught by Mulgund) (Madden, section 4 under In-Network Aggregates).

Mulgund at paragraphs 0025, 0026, and 0062 recites:

[0025] It is of no concern how this network topology came into being, how it is organized, what routing algorithms are used to pass messages from one node to the next, but rather, how to aggregate the information at each of the nodes into an off-network repository or network model database 12. The sensing nodes 2 may be mobile, and the interconnections may change over time. Furthermore, new nodes may join the network 4 at any time, and existing nodes may leave the network unexpectedly.

[0026] FIG. 2 illustrates the nature of each of the sensing nodes 2, which comprise computational devices (possibly ranging in complexity from small embedded platforms to a fully-fledged PCs) that have one or more sensors 16 providing high-value information connected to it. The term sensor is used here in a general sense. A sensor 16 as contemplated herein could be as simple as an instrument that measures temperature, pressure, or any such other physical quantity. It could also be a device as complex as a video camera providing continuous full-motion imagery of some area of interest. In any case, the output of each of these sensors 16 is stored locally in a well-defined knowledge base 18, but the output can be accessed from outside the network 4 through some software application programming interface (API) and hardware implementation. Each of the sensing nodes 2 is additionally in communication with one or more other sensing nodes through connecting links 3.

[0062] The traversal process begins at node A 32. Node A 32 is visited and pushed onto the stack. The process of visiting a node involves retrieving the information stored at the node, and updating the local database.

Madden at the abstract, section 1.1, paragraph 2, section 4, and section 4.1, paragraphs 1 and 2 recites:

We present the Tiny AGgregation (TAG) service for aggregation in TinyOS. TAG allows users to express simple, declarative queries and have them distributed and executed efficiently in networks of low-power, wireless sensors. We discuss

various generic properties of aggregates, and show how those properties affect the performance of our in-network approach. We include a performance study demonstrating the advantages of our approach over traditional centralized, out-of-network methods, and discuss a variety of optimizations for improving the performance and fault-tolerance of the basic solution.

TAG operates as follows: users pose aggregation queries from a powered, storage-rich basestation. Operators that implement the query are distributed into the network by piggybacking on the existing ad hoc networking protocol. Sensors route data back towards the user through a routing tree rooted at the basestation. As data flows up this tree, it is aggregated according to an aggregation function and value-based partitioning specified in the query. For example, consider the problem of counting the number of nodes in a network of indeterminate size. First, the request to count is injected into the network. Then, each leaf node in the tree reports a count of 1 to their parent; interior nodes sum the count of their children, add 1 to it, and report that value to their parent. Counts propagate up the tree in this manner, and flow out at the root.

Given the simple routing protocol from Section 2.1 and our SQL-like query model, we now discuss the implementation of the core TAG algorithm for in-network aggregation.

A naive implementation of sensor network aggregation would be to use a centralized, server-based approach where all sensor readings are sent to the base station, which then computes the aggregates. In TAG, however, we compute aggregates in-network whenever possible, because, if properly implemented, this approach can be lower in number of message transmissions, latency, and power consumption than the server-based approach. We will measure the advantage of in-network aggregation in Section 5 below; first, we present the basic algorithm in detail. We first consider the operation of the basic approach in the absence of grouping; we show how to extend it with grouping in Section 4.2.

TAG consists of two phases: a distribution phase, in which aggregate queries are pushed down into the network, and a collection phase, where the aggregate values are continually routed up from children to parents. Recall that our query semantics partition time into epochs of duration i, and that we must produce a single aggregate value (when not grouping) that combines the readings of all sensors in the network during that epoch.

Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.

Claim 1 recites, "transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes." The Office action, in rejection claim 1 cites to paragraphs 0025 and 0062 of Mulgund *et al.*:

> [0025] It is of no concern how this network topology came into being, how it is organized, what routing algorithms are used to pass messages from one node to the next, but rather, how to aggregate the information at each of the nodes into an off-network repository or network model database 12. The sensing nodes 2 may be mobile, and the interconnections may change over time. Furthermore, new nodes may join the network 4 at any time, and existing nodes may leave the network unexpectedly.
>
> [0062] The traversal process begins at node A 32. Node A 32 is visited and pushed onto the stack. The process of visiting a node involves retrieving the information stored at the node, and updating the local database.

However, in contrast to the recitations of claim 1, the recitations from Mulgund *et al.* fail to recite, "transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes." Further, Mulgund *et al.* fail to recite "one or more mote-addressed content indexes," as recited in claim 1. Still further, based on an analysis of the Office action, the above quoted recitation from Mulgund *et al.* and claim 1, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Mulgund *et al.* with the recitation of claim 1, "transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes." Hence, the Office action fails to show how Mulgund *et al.* teach or suggest, "transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes." Thus, the Office action fails to state a *prima facie* case of anticipation with respect to claim 1. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 1.

Further, the Office action, recites:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund by transmitting at least a part of an aggregate of one of more mote-addressed content indexes in order to lower the number of message transmissions, latency, and power consumption that the server-based approach (as taught by Mulgund) (Madden, section 4 under In-Network Aggregates).

Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 1, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 1. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 1.

As the Office action provides no support for the statement that the combination is obvious to one of ordinary skill in the art (i.e., the recitations of Madden *et al.* fail to recite "content indexes" or "transmitting . . . content indexes. . . ", and therefore do not support the conclusion that the combination is obvious), applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

2. Dependent Claims 2-12 Patentable for at Least Reasons of Dependency from Independent Claim 1

Claims 2-12 depend either directly or indirectly from Independent Claim 1. "A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers." *See* 35 U.S.C. § 112 paragraph 4. Consequently, Dependent Claims 2-12 are patentable for at least the reasons why Independent Claim 1 is patentable. Accordingly, Applicant respectfully requests that Examiner hold Dependent Claims 2-12 patentable for at least the foregoing reasons, and issue a Notice of Allowability on same.

3. Dependent Claim 2 Independently Patentable

Notwithstanding its dependency from Dependent Claim 1, Dependent Claim 2 is patentable on its own merits.

Claims 2 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al* (hereinafter Madden Ref.1) and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden et al. Applicant respectfully traverses the rejection of claim 2.

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 2 recites:

> 2. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> transmitting at least a part of at least one of a mote-addressed sensing index or a mote-addressed control index.

The Office action, at page 6, paragraph 13, recites:

> Claims 2 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al (hereinafter Madden Ref.1) and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden et al. (hereinafter Madden Ref. 2).

More specifically, the Office action, at page 7, paragraph 12, recites:

> As to claim 2, Mulgund in view of Madden Ref. 1 shows all the elements except for sensing index being transmitted [sensors route data back towards the

user through a routing tree rooted at the basestation] (section 1.1 paragraph 2, Madden Ref. 1).

Madden Ref. 2 shows at least one of a mote-addressed sensing index [a sensor table of sensors' readings (section 3.1 Basic Language Features)].

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund in view of Madden Ref. 1 by transmitting at least a part of at least one of a mote-addressed sensing index in order to report sensor id, light, and temperature. readings (section 3.1 Basic Language Features, Madden Ref. 2) and (section 2 last paragraph, Madden Ref. 1).

Madden Ref. 1 at section 1.1 paragraph 2 recites:

We have developed Tiny AGgregation (TAG), a generic aggregation service for ad hoc networks of TinyOS motes. There are two essential attributes of this service. First, it provides a simple, declarative interface for aggregation, inspired by aggregation operators in database query languages. Second, it intelligently distributes and executes aggregation operators in the sensor network in a time and power-efficient manner, and is sensitive to the resource constraints and lossy communication properties of wireless sensor mote networks. TAG processes aggregates in network by computing over the data as it flows through the sensors, discarding irrelevant data and combining relevant readings into more compact records whenever possible.

Madden 2 at section 3.1 recites:

Queries in TinyDB, as in SQL, consist of a SELECT-FROM-WHERE clause supporting selection, join, projection, and aggregation. We also include explicit support for sampling, windowing, and sub-queries via materialization points. As is the case in the Cougar and TAG work [41, 34], we view sensor data as a single table with one column per sensor type. Tuples are appended to this table periodically, at well-defined sample intervals that are a parameter of the query. The period of time between each sample interval is known as an epoch. As we discuss in Section 6, epochs provide a convenient mechanism for structuring computation to minimize power consumption. Consider the query:
SELECT nodeid, light, temp FROM sensors
SAMPLE INTERVAL is FOR lOs
This query specifies that each sensor should report its own id, light, and temperature readings (contained in the virtual table sensors) once per second for 10 seconds. Results of this query stream to the root of the network in an online fashion, via the multi-hop topology, where they may be logged or output to the user. The output consists of a sequence of tuples, clustered into Is time intervals. Each tuple includes a time stamp corresponding to the time it was produced. Note that the sensors table is (conceptually) an unbounded, continuous data stream of values; as is the case in other streaming and online systems, certain blocking operations (such as sort and symmetric join) are not allowed over such

streams unless a bounded subset of the stream, or window, is specified. Windows in TinyDB are defined as fixed-size materialization points over the sensor streams. Such materialization points accumulate a small buffer of data that may be used in other queries. Consider, as an example:

```
CREATE
STORAGE POINT recentlight SIZE 8
AS (SELECT nodeid, light FROM sensors SAMPLE INTERVAL 10s)
```

This statement provides a shared, local (i.e. single-node) location to store a streaming view of recent data similar to materialization points in

or between a storage point and the sensors relation, in which case sensors is used as the outer relation in a nested-loops join. That is, when a sensors tuple arrives, it is joined with tuples in the storage point at its time of arrival. This is effectively a landmark query [19] common in streaming systems. Consider, as an example:

```
SELECT COUNT(*)
FROM sensors AS s, recentLight AS rl WHERE rl.nodeid = s.nodeid
AND s.light    rl.light
SAMPLE INTERVAL lOs
```

This query outputs a stream of counts indicating the number of recent light readings (from 0 to 8 samples in the past) that were brighter than the current reading. In the event that a storage point and an outer query deliver data at different rates, a simple rate matching construct is provided that allows interpolation between successive samples (if the outer query is faster), or specification of aggregation function to combine multiple rows (if the inner query is faster.) Space prevents a detailed description of this mechanism here.

TinyDB also includes support for grouped aggregation queries. Aggregation has the attractive property that it reduces the quantity of data that must be transmitted through the network; other sensor network research has noted that aggregation is perhaps the most common operation in the domain ([34, 27, 48]). TinyDB includes a mechanism for user-defined aggregates and a metadata management system that supports optimizations over them, which we discuss in Section 4.1.

In addition to aggregates over values produced during the same sample interval (for an example, as in the COUNT query above), users want to be able to perform temporal operations. For example, in a building monitoring system for conference rooms, users may detect occupancy by measuring maximum sound volume over time and reporting that volume periodically; for example, the query:

```
SELECT WINAVG(volume, 30s, 5s) FROM sensors
SAMPLE INTERVAL is
```

will report the average volume over the last 30 seconds once every 5 seconds, sampling once per second. This is an example of a sliding-window query common in many streaming systems [39, 19].

When a query is issued in TinyDB, it is assigned an identifier (id) that is returned to the issuer. This identifier can be used to explicitly stop a query via a "STOP QUERY id" command. Alternatively, queries can be limited to run for a specific time period via a FOR clause (shown above,) or can include a stopping condition as an event (see below.)

Madden Ref. 1 at section 2, last paragraph recites:

Messages in the current generation of TinyOS are a fixed size — by default, 30 bytes. Each sensor has a unique sensor ID that distinguishes it from others. All messages specify their recipient (or specify broadcast, meaning all available recipients), allowing sensors to ignore messages not intended for them, although non-broadcast messages are received by all sensors within range — unintended recipients simply drop messages not addressed to them.

Claim 2 recites, "transmitting at least a part of at least one of a mote-addressed sensing index or a mote-addressed control index." The Office action, in support of the rejection of claim 2, at page 7, paragraph 12, recites:

Madden Ref. 2 shows at least one of a mote-addressed sensing index [a sensor table of sensors' readings (section 3.1 Basic Language Features)].

And Madden 2 at section 3.1 recites:

Queries in TinyDB, as in SQL, consist of a SELECT-FROM-WHERE clause supporting selection, join, projection, and aggregation. We also include explicit support for sampling, windowing, and sub-queries via materialization points. As is the case in the Cougar and TAG work [41, 34], we view sensor data as a single table with one column per sensor type. Tuples are appended to this table periodically, at well-defined sample intervals that are a parameter of the query. The period of time between each sample interval is known as an epoch. As we discuss in Section 6, epochs provide a convenient mechanism for structuring computation to minimize power consumption. Consider the query:
SELECT nodeid, light, temp FROM sensors
SAMPLE INTERVAL is FOR lOs
This query specifies that each sensor should report its own id, light, and temperature readings (contained in the virtual table sensors) once per second for 10 seconds. Results of this query stream to the root of the network in an online fashion, via the multi-hop topology, where they may be logged or output to the user. The output consists of a sequence of tuples, clustered into Is time intervals. Each tuple includes a time stamp corresponding to the time it was produced. Note that the sensors table is (conceptually) an unbounded, continuous data stream of values; as is the case in other streaming and online systems, certain blocking operations (such as sort and symmetric join) are not allowed over such streams unless a bounded subset of the stream, or window, is specified. Windows in TinyDB are defined as fixed-size materialization points over the sensor streams. Such materialization points accumulate a small buffer of data that may be used in other queries. Consider, as an example:

CREATE
STORAGE POINT recentlight SIZE 8
AS (SELECT nodeid, light FROM sensors SAMPLE INTERVAL 10s)
This statement provides a shared, local (i.e. single-node) location to store a streaming view of recent data similar to materialization points in
or between a storage point and the sensors relation, in which case sensors is used as the outer relation in a nested-loops join. That is, when a sensors tuple arrives, it is joined with tuples in the storage point at its time of arrival. This is effectively a landmark query [19] common in streaming systems. Consider, as an example:
SELECT COUNT(*)
FROM sensors AS s, recentLight AS rl WHERE rl.nodeid = s.nodeid
AND s.light rl.light
SAMPLE INTERVAL lOs
This query outputs a stream of counts indicating the number of recent light readings (from 0 to 8 samples in the past) that were brighter than the current reading. In the event that a storage point and an outer query deliver data at different rates, a simple rate matching construct is provided that allows interpolation between successive samples (if the outer query is faster), or specification of aggregation function to combine multiple rows (if the inner query is faster.) Space prevents a detailed description of this mechanism here.
TinyDB also includes support for grouped aggregation queries. Aggregation has the attractive property that it reduces the quantity of data that must be transmitted through the network; other sensor network research has noted that aggregation is perhaps the most common operation in the domain ([34, 27, 48]). TinyDB includes a mechanism for user-defined aggregates and a metadata management system that supports optimizations over them, which we discuss in Section 4.1.
In addition to aggregates over values produced during the same sample interval (for an example, as in the COUNT query above), users want to be able to perform temporal operations. For example, in a building monitoring system for conference rooms, users may detect occupancy by measuring maximum sound volume over time and reporting that volume periodically; for example, the query:
SELECT WINAVG(volume, 30s, 5s) FROM sensors
SAMPLE INTERVAL is
will report the average volume over the last 30 seconds once every 5 seconds, sampling once per second. This is an example of a sliding-window query common in many streaming systems [39, 19].
When a query is issued in TinyDB, it is assigned an identifier (id) that is returned to the issuer. This identifier can be used to explicitly stop a query via a "STOP QUERY id" command. Alternatively, queries can be limited to run for a specific time period via a FOR clause (shown above,) or can include a stopping condition as an event (see below.)

However, in contrast to the recitations of claim 2, the recitations from Madden *et al.* fail to recite,

"transmitting at least a part of at least one of a mote-addressed sensing index or a mote-addressed control index." Further, Madden *et al.* fail to recite "a mote-addressed sensing index or a mote-addressed control index." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 2, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 2, "transmitting at least a part of at least one of a mote-addressed sensing index or a mote-addressed control index." Hence, the Office action fails to show how Mulgund *et al.* teach or suggest, "transmitting at least a part of at least one of a mote-addressed sensing index or a mote-addressed control index." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 2. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 2.

Further, the Office action, at page 7, paragraph 12, recites:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund in view of Madden Ref. 1 by transmitting at least a part of at least one of a mote-addressed sensing index in order to report sensor id, light, and temperature. readings (section 3.1 Basic Language Features, Madden Ref. 2) and (section 2 last paragraph, Madden Ref. 1).

Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund Ref. 1 and Madden Ref. 2 as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 2, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 2. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 2.

As the Office action provides no support for the statement that the combination is obvious to one of ordinary skill in the art (i.e., the Office action fails to cite to the references in support of the teaching, suggestion or motivation to combine; and therefore provides no support for the conclusion that the combination is obvious), applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

4. Dependent Claim 3 Independently Patentable

Notwithstanding its dependency from Dependent Claim 1, Dependent Claim 3 is patentable on its own merits.

Claim 3 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et a*l. Applicant respectfully traverses the rejection of claim 3.

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 3 recites:

> 3. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> transmitting at least a part of a mote-addressed routing/spatial index.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action, at page 7, paragraph 12, recites:

As to claim 3, Mulgund in view of Madden shows transmitting at least a part of a mote-addressed routing/spatial index (section 2.1, paragraphs 2 and 3, Madden).

Madden at section 2.1, paragraphs 2 and 3 recites:

> In the tree-based routing scheme, one sensor is appointed to be the root, usually because it is the point where the user interfaces to the network. The root broadcasts a message asking sensors to organize into a routing tree; in that

> message it specifies its own id and its level, or distance from the root (in this case, zero.) Any sensor without an assigned level that hears this message assigns its own level to be the level in the message plus one. It also chooses the sender of the message as its parent, through which it will route messages to the root.
>
> Each of these sensors then rebroadcasts the routing message, inserting their own ids and levels. The routing message floods down the tree in this fashion, with each node rebroadcasting the message until all nodes have been assigned a level and a parent. These routing messages are periodically broadcast from the root, so that the process of topology discovery goes on continuously. This constant topology maintenance makes it relatively easy to adapt to network changes caused by mobility of certain nodes, or to the addition or deletion of sensors. To maintain stability in the network, parents are retained unless a child does not hear from them for some long period of time, at which point it selects a new parent using this same process. We will look in more detail at the robustness of this approach with respect to loss and its effect on aggregate values in Section 7.

Claim 3 recites, "transmitting at least a part of a mote-addressed routing/spatial index." The Office action, at page 7, paragraph 12, in support of the rejection recites:

> As to claim 3, Mulgund in view of Madden shows transmitting at least a part of a mote-addressed routing/spatial index (section 2.1, paragraphs 2 and 3, Madden).
>
> And Madden at section 2.1, paragraphs 2 and 3 recites:
>
> In the tree-based routing scheme, one sensor is appointed to be the root, usually because it is the point where the user interfaces to the network. The root broadcasts a message asking sensors to organize into a routing tree; in that message it specifies its own id and its level, or distance from the root (in this case, zero.) Any sensor without an assigned level that hears this message assigns its own level to be the level in the message plus one. It also chooses the sender of the message as its parent, through which it will route messages to the root.
>
> Each of these sensors then rebroadcasts the routing message, inserting their own ids and levels. The routing message floods down the tree in this fashion, with each node rebroadcasting the message until all nodes have been assigned a level and a parent. These routing messages are periodically broadcast from the root, so that the process of topology discovery goes on continuously. This constant topology maintenance makes it relatively easy to adapt to network changes caused by mobility of certain nodes, or to the addition or deletion of sensors. To maintain stability in the network, parents are retained unless a child does not hear from them for some long period of time, at which point it selects a new parent using this same process. We will look in more detail at the robustness of this approach with respect to loss and its effect on aggregate values in Section 7.

However, in contrast to the recitations of claim 3, the recitations from Madden *et al.* fail to recite, "transmitting at least a part of a mote-addressed routing/spatial index." Further, Madden *et al.* fail to recite "a mote-addressed routing/spatial index." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 3, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 3, "mote-addressed routing/spatial index." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "mote-addressed routing/spatial index." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 3. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 3.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund Ref. 1 and Madden Ref. 2 as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 3, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 3. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 3.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests

that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

5. Dependent Claim 4 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 4 is patentable on its own merits.

Claim 4 rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 4.

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 4 is dependent on claim 1. Claim 4 recites:

> 4. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> effecting the transmitting with a reporting entity.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action, at page 7, paragraph 12, recites:

> As to claim 4, Mulgund in view of Madden shows effecting the transmission with a reporting entity [Tiny0S, the mote operating system] (section 1 Introduction, paragraph 1, Madden).

Madden at section 1 Introduction, paragraph 1 recites:

> Recent advances in computing technology have led to the production of a new class of computing device: the wireless, battery powered, smart sensor. These new

> sensors are active, full fledged computers, capable not only of measuring real world phenomena but also filtering, sharing, and combining those measurements. One example of such small sensor devices are the motes under development at UC Berkeley. Current generation motes are roughly 2cm x 4cm x lcm and are equipped with a radio, a processor, memory, a small battery pack, and a suite of sensors. The mote operating system, TinyOS, provides a set of primitives designed to facilitate the deployment of motes in ad-hoc networks. In such networks, devices can locate each other and route data without prior knowledge of or assumptions about the network topology, thereby allowing the network topology to change as devices move, run out of power, or experience shifting waves of interference.

Claim 4 recites, "effecting the transmitting with a reporting entity." In support of the rejection, the Office action, at page 7, paragraph 12, recites:

> As to claim 4, Mulgund in view of Madden shows effecting the transmission with a reporting entity [Tiny0S, the mote operating system] (section 1 Introduction, paragraph 1, Madden).
>
> And Madden at section 1 Introduction, paragraph 1 recites:
>
> Recent advances in computing technology have led to the production of a new class of computing device: the wireless, battery powered, smart sensor. These new sensors are active, full fledged computers, capable not only of measuring real world phenomena but also filtering, sharing, and combining those measurements. One example of such small sensor devices are the motes under development at UC Berkeley. Current generation motes are roughly 2cm x 4cm x lcm and are equipped with a radio, a processor, memory, a small battery pack, and a suite of sensors. The mote operating system, TinyOS, provides a set of primitives designed to facilitate the deployment of motes in ad-hoc networks. In such networks, devices can locate each other and route data without prior knowledge of or assumptions about the network topology, thereby allowing the network topology to change as devices move, run out of power, or experience shifting waves of interference.

However, in contrast to the recitations of claim 4, the recitations from Madden *et al.* fail to recite, "effecting the transmitting with a reporting entity." Further, Madden *et al.* fail to recite "a reporting entity." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 4, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate

the above quoted material from Madden *et al.* with the recitation of claim 4, "effecting the transmitting with a reporting entity." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "effecting the transmitting with a reporting entity." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 4. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 4.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 4, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 4. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 4.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

6. Dependent Claim 5 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 5 is patentable on its own merits.

Claim 5 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 5.

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 5 is dependent on claim 1. Claim 5 recites:

> 5. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> obtaining access to the one or more mote-addressed content indexes of the first set of motes.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action, at page 7, paragraph 12, recites:

> As to claim 5, Mulgund in view of Madden shows obtaining access to the one or more mote-addressed content indexes of the first set of motes [parent node obtaining a message from a child node, message containing one or more mote-addressed content indexes) (section 2.1, last paragraph, Madden).

Madden at section 2.1, last paragraph recites:

> When a sensor wishes to send a message to the root, it broadcasts a message addressed to its parent, which in turn forwards the message on to its parent, and so on, eventually reaching the root. In the Section 4, we show how, as data is routed towards the root, it can be combined with data from other sensors to efficiently combine routing and aggregation. Now, however, we turn to the syntax and semantics of aggregate queries in TAG.

Claim 5 recites, "obtaining access to the one or more mote-addressed content indexes of the first set of motes." In support of the rejection, the Office action, at page 7, paragraph 12, recites:

> As to claim 5, Mulgund in view of Madden shows obtaining access to the one or more mote-addressed content indexes of the first set of motes [parent node obtaining a message from a child node, message containing one or more mote-addressed content indexes) (section 2.1, last paragraph, Madden).
>
> And Madden at section 2.1, last paragraph recites:
>
> When a sensor wishes to send a message to the root, it broadcasts a message addressed to its parent, which in turn forwards the message on to its parent, and so on, eventually reaching the root. In the Section 4, we show how, as data is routed towards the root, it can be combined with data from other sensors to efficiently combine routing and aggregation. Now, however, we turn to the syntax and semantics of aggregate queries in TAG.

However, in contrast to the recitations of claim 5, the recitations from Madden *et al.* fail to recite, "obtaining access to the one or more mote-addressed content indexes of the first set of motes." Further, Madden *et al.* fail to recite "mote-addressed content indexes." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 5, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 5, "obtaining access to the one or more mote-addressed content indexes of the first set of motes." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "obtaining access to the one or more mote-addressed content indexes of the first set of motes." Thus, the Office action fails to state a *prima facie* case of obviousness with

respect to claim 5. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 5.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 5, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 5. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 5.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

7. Dependent Claim 6 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 6 is patentable on its own merits.

Claim 6 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 6.

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 6 recites:

> 6. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> effecting the transmitting in response to a schedule.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action, at page 7, paragraph 12, recites:

> As to claim 6, Mulgund in view of Madden shows effecting the transmission in response to a schedule (Madden, section 4.1, paragraphs 2 and 3).

Madden section 4.1, paragraphs 2 and 3 recites:

> Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.
>
> When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

Claim 6 recites, "effecting the transmitting in response to a schedule." In support of the rejection, the Office action, at page 7, paragraph 12, recites:

> As to claim 6, Mulgund in view of Madden shows effecting the transmission in response to a schedule (Madden, section 4.1, paragraphs 2 and 3).

And Madden at section 4.1, paragraphs 2 and 3 recites:

> Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.
>
> When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based

> approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

However, in contrast to the recitations of claim 6, the recitations from Madden *et al.* fail to recite, "effecting the transmitting in response to a schedule." Further, Madden *et al.* fail to recite "effecting the transmitting in response to a schedule." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 6, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 6, "effecting the transmitting in response to a schedule." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "effecting the transmitting in response to a schedule." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 6. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 6.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under <u>*In re* Sang Su Lee</u>:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." <u>W.L. Gore v. Garlock, Inc.</u>, 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 6, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 6. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 6.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or

declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

8. Dependent Claim 7 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 7 is patentable on its own merits.

Claim 7 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 7

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 6 recites:

> 6. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> effecting the transmitting in response to a schedule.

Claim 7 is dependent on claim 6. Claim 7 recites:

> 7. The method of Claim 6, wherein said effecting the transmitting in response to a schedule further comprises:
> receiving the schedule.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action, at page 7, paragraph 12, recites:

> As to claim 7, Mulgund in view of Madden shows receiving the schedule (Madden, section 4.1, paragraphs 2 and 3).

Madden section 4.1, paragraphs 2 and 3 recites:

> Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.
>
> When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

Claim 7 recites, "receiving the schedule." In support of the rejection, the Office action, at page 7, paragraph 12, recites:

> As to claim 7, Mulgund in view of Madden shows receiving the schedule (Madden, section 4.1, paragraphs 2 and 3).

And Madden section 4.1, paragraphs 2 and 3 recites:

> Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.

> When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

However, in contrast to the recitations of claim 7, the recitations from Madden *et al.* fail to recite, "receiving the schedule." Further, Madden *et al.* fail to recite "the schedule." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 7, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 7, "receiving the schedule." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "receiving the schedule." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 7. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 7.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 7, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 7. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 7.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

9. Dependent Claim 8 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 8 is patentable on its own merits.

Claim 8 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 8

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 6 recites:

> 6. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> effecting the transmitting in response to a schedule.

Claim 8 recites:

> 8. The method of Claim 6, wherein said effecting the transmitting in response to a schedule further comprises:
> deriving the schedule.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action, at page 7, paragraph 12, recites:

> As to claim 8, Mulgund in view of Madden shows deriving the schedule (Madden, section 4.1, paragraphs 2 and 3).
>
> Madden section 4.1, paragraphs 2 and 3 recites:
>
> > Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.
> >
> > When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

Claim 8 recites, "deriving the schedule." In support of the rejection, the Office action, at page 7, paragraph 12, recites:

> As to claim 8, Mulgund in view of Madden shows deriving the schedule (Madden, section 4.1, paragraphs 2 and 3).
>
> Madden section 4.1, paragraphs 2 and 3 recites:
>
> > Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.
> >
> > When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing

> information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

However, in contrast to the recitations of claim 8, the recitations from Madden *et al.* fail to recite, "deriving the schedule." Further, Madden *et al.* fail to recite "the schedule." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 8, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 8, "deriving the schedule." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "deriving the schedule." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 8. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 8.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 8, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 8. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 8.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office

maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

10. Dependent Claim 9 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 9 is patentable on its own merits.

Claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 9

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 6 recites:

> 6. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> effecting the transmitting in response to a schedule.

Claim 9 recites:

> 9. The method of Claim 6, wherein said effecting the transmitting in response to a schedule further comprises:
> deriving the schedule at least in part from at least one of an optimized query or a stored query.

The Office action at page 6, paragraph 12, recites:

Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action at page 7, paragraph 12, recites:

> As to claim 9, Mulgund in view of Madden shows deriving the schedule at least in part from at least one of an optimized query or a stored query (Madden, section 4.1, paragraphs 2 and 3).

Madden section 4.1, paragraphs 2 and 3 recites:

> Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.
>
> When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

Claim 9 recites, "deriving the schedule." In support of the rejection, the Office action, at page 7, paragraph 12, recites:

> As to claim 9, Mulgund in view of Madden shows deriving the schedule at least in part from at least one of an optimized query or a stored query (Madden, section 4.1, paragraphs 2 and 3).

And Madden section 4.1, paragraphs 2 and 3 recites:

> Given our goal of using as few messages as possible, the collection phase must insure that parents in the routing tree wait until they have heard from their children before propagating an aggregate value for the current epoch. We will accomplish this by having parents subdivide the epoch such that children are required to deliver their partial state records during a parent-specified time interval. This interval is selected such that there is enough time for the parent to combine partial state records and propagate its own record to its parent.
>
> When a sensor p receives a request to aggregate, r, either from another sensor or from the user, it awakens, synchronizes its clock according to timing information in the message, and prepares to participate in aggregation. In the tree based routing scheme, p chooses the sender of the message as its parent. In addition to the information in the query, r includes the interval when the sender is expecting to hear partial state records from p. p then forwards the query request r down the network, setting this delivery interval for children to be slightly before the time its parent expects to see p's partial state record. In the tree-based approach, this forwarding consists of a broadcast of r, to include any nodes that did not hear the previous round, and include them as children (if it has any.) These nodes continue to forward the request in this manner, until the query has been propagated throughout the network.

However, in contrast to the recitations of claim 9, the recitations from Madden *et al.* fail to recite, "deriving the schedule at least in part from at least one of an optimized query or a stored query." Further, Madden *et al.* fail to recite "an optimized query." Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 9, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 9, "deriving the schedule at least in part from at least one of an optimized query or a stored query." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "deriving the schedule at least in part from at least one of an optimized query or a stored query." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 9. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 9.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under <u>*In re* Sang Su Lee:</u>

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 9, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 9. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 9.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

11. Dependent Claim 10 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 10 is patentable on its own merits.

Claim 10 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 10

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 10 recites:

> 10. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> effecting the transmitting in response to a query.

The Office action at page 6, paragraph 12, recites:

> Claims 1, 3-10, 13, and 15-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al.

More specifically, the Office action, at page 7, paragraph 12, recites:

> As to claim 10, Mulgund in view of Madden shows effecting the transmission in response to a query (Madden, abstract, section 1.1 the TAG Approach).

Madden in the abstract and at section 1.1 recites:

We present the Tiny AGgregation (TAG) service for aggregation in TinyOS. TAG allows users to express simple, declarative queries and have them distributed and executed efficiently in networks of low-power, wireless sensors. We discuss various generic properties of aggregates, and show how those properties affect the performance of our in-network approach. We include a performance study demonstrating the advantages of our approach over traditional centralized, out-of-network methods, and discuss a variety of optimizations for improving the performance and fault-tolerance of the basic solution.

We have developed Tiny AGgregation (TAG), a generic aggregation service for ad hoc networks of TinyOS motes. There are two essential attributes of this service. First, it provides a simple, declarative interface for aggregation, inspired by aggregation operators in database query languages. Second, it intelligently distributes and executes aggregation operators in the sensor network in a time and power-efficient manner, and is sensitive to the resource constraints and lossy communication properties of wireless sensor mote networks. TAG processes aggregates in network by computing over the data as it flows through the sensors, discarding irrelevant data and combining relevant readings into more compact records whenever possible.

TAG operates as follows: users pose aggregation queries from a powered, storage-rich basestation. Operators that implement the query are distributed into the network by piggybacking on the existing ad hoc networking protocol. Sensors route data back towards the user through a routing tree rooted at the basestation. As data flows up this tree, it is aggregated according to an aggregation function and value-based partitioning specified in the query. For example, consider the problem of counting the number of nodes in a network of indeterminate size. First, the request to count is injected into the network. Then, each leaf node in the tree reports a count of 1 to their parent; interior nodes sum the count of their children, add 1 to it, and report that value to their parent. Counts propagate up the tree in this manner, and flow out at the root.

Claim 10 recites, "effecting the transmitting in response to a query." In support of the rejection, the Office action, at page 7, paragraph 12, recites:

As to claim 10, Mulgund in view of Madden shows effecting the transmission in response to a query (Madden, abstract, section 1.1 the TAG Approach).

Madden in the abstract and at section 1.1 recites:

We present the Tiny AGgregation (TAG) service for aggregation in TinyOS. TAG allows users to express simple, declarative queries and have them distributed and executed efficiently in networks of low-power, wireless sensors. We discuss various generic properties of aggregates, and show how those

> properties affect the performance of our in-network approach. We include a performance study demonstrating the advantages of our approach over traditional centralized, out-of-network methods, and discuss a variety of optimizations for improving the performance and fault-tolerance of the basic solution.
>
> We have developed Tiny AGgregation (TAG), a generic aggregation service for ad hoc networks of TinyOS motes. There are two essential attributes of this service. First, it provides a simple, declarative interface for aggregation, inspired by aggregation operators in database query languages. Second, it intelligently distributes and executes aggregation operators in the sensor network in a time and power-efficient manner, and is sensitive to the resource constraints and lossy communication properties of wireless sensor mote networks. TAG processes aggregates in network by computing over the data as it flows through the sensors, discarding irrelevant data and combining relevant readings into more compact records whenever possible.
>
> TAG operates as follows: users pose aggregation queries from a powered, storage-rich basestation. Operators that implement the query are distributed into the network by piggybacking on the existing ad hoc networking protocol. Sensors route data back towards the user through a routing tree rooted at the basestation. As data flows up this tree, it is aggregated according to an aggregation function and value-based partitioning specified in the query. For example, consider the problem of counting the number of nodes in a network of indeterminate size. First, the request to count is injected into the network. Then, each leaf node in the tree reports a count of 1 to their parent; interior nodes sum the count of their children, add 1 to it, and report that value to their parent. Counts propagate up the tree in this manner, and flow out at the root.

However, in contrast to the recitations of claim 10, the recitations from Madden *et al.* fail to recite, "effecting the transmitting in response to a query." Further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 10, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Madden *et al.* with the recitation of claim 10, "effecting the transmitting in response to a query." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "effecting the transmitting in response to a query." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 10. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 10.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits

that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 10, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 10. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 10.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

12. Dependent Claim 11 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 11 is patentable on its own merits.

Claim 11 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al. and in further view of Regli *et al.* (2005/0141706). Applicant respectfully traverses the rejection of claim 11

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 11 recites:

> 11. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> encrypting utilizing at least one of a private or a public key.

The Office action, at page 9, paragraph 14, recites:

> Claims 11, 12, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentabie [sic] over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al. and in further view of Regli et al. (2005/0141706).

More specifically, the Office action at page 9 and page 10, paragraph 14, recites:

> As to claim 11, Mulgund in view of Madden shows all the elements except for encrypting utilizing at least one of a private or a public key. Regli shows encrypting utilizing at least one of a private or a public key (paragraph [0056]). It

would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund in view of Madden by encrypting utilizing at least one of a private or a public key in order to support encrypted communication at the network layer between wireless devices (paragraphs [0054]-[0056] in Regli).

Regli at paragraphs 0054-0056 recites:

[0054] The Secure Wireless Agent Testbed (SWAT) is a live laboratory to study integration, networking and information assurance for next-generation wireless mobile agent systems. Specifically, the SWAT infrastructure comprises of PDA-based computing platforms on a wireless network with ad hoc routing. Although not shown, any type of computer, cellular telephone, digital or electronic device capable of transmitting information may be used instead of or in addition to PDA-based computing platforms. The physical network infrastructure is based on IEEE standard 802.11b wireless LAN technology or a technology similar thereto, using network interface cards, including, but not limited to, network interface cards manufactured by Cisco. The software infrastructure for SWAT is generally OpenSource: Linux Familiar OS 0.5.3 (Kernel 2.4.18), Blackdown Java 1.3.1, OpenSSL, IPSec, and EMAA; and non-OpenSource software infrastructure may be also be implemented in conjunction with or instead of the OpenSource code. The software is uniform across nodes.

[0055] An accomplishment of SWAT is the operational integration of a contributory group key generating algorithm in conjunction with a key agreement protocol, a messaging system for running the key agreement protocol and a mechanism for revoking the key from an agent, user, group, network or host, and demonstration of their purposeful use on live ad hoc routed networks. Group communication through a collection of agent-enabled applications that include collaboration and situation awareness has been secured on multiple layers. Secure subgroups have been created with all related key management including real-time user revocation.

[0056] The security framework uses a combination of symmetric and public-key cryptography to support encrypted communication at both the network and the agent application layers. SWAT is capable of supporting secure group communication, via shared key generation, for groups and sub-groups of computing hosts and agents. Security is monitored by agents that manage keys, assess network traffic patterns and analyze host behaviors. Using this framework, agents can revoke access rights for suspicious hosts or agents and adaptively re-route traffic at the network layer to improve the information integrity of the overall system. Lastly, agents provide the implementation framework for a number of decentralized user applications, including, but not limited to, those for user authentication, collaboration, messaging and remote sensor monitoring.

Claim 11 recites, "encrypting utilizing at least one of a private or a public key." In support of the rejection, the Office action, at page 9 and page 10, paragraph 14, recites:

> As to claim 11, Mulgund in view of Madden shows all the elements except for encrypting utilizing at least one of a private or a public key. Regli shows encrypting utilizing at least one of a private or a public key (paragraph [0056]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund in view of Madden by encrypting utilizing at least one of a private or a public key in order to support encrypted communication at the network layer between wireless devices (paragraphs [0054]-[0056] in Regli).

Regli at paragraphs 0054-0056 recites:

[0054] The Secure Wireless Agent Testbed (SWAT) is a live laboratory to study integration, networking and information assurance for next-generation wireless mobile agent systems. Specifically, the SWAT infrastructure comprises of PDA-based computing platforms on a wireless network with ad hoc routing. Although not shown, any type of computer, cellular telephone, digital or electronic device capable of transmitting information may be used instead of or in addition to PDA-based computing platforms. The physical network infrastructure is based on IEEE standard 802.11b wireless LAN technology or a technology similar thereto, using network interface cards, including, but not limited to, network interface cards manufactured by Cisco. The software infrastructure for SWAT is generally OpenSource: Linux Familiar OS 0.5.3 (Kernel 2.4.18), Blackdown Java 1.3.1, OpenSSL, IPSec, and EMAA; and non-OpenSource software infrastructure may be also be implemented in
conjunction with or instead of the OpenSource code. The software is uniform across nodes.

[0055] An accomplishment of SWAT is the operational integration of a contributory group key generating algorithm in conjunction with a key agreement protocol, a messaging system for running the key agreement protocol and a mechanism for revoking the key from an agent, user, group, network or host, and demonstration of their purposeful use on live ad hoc routed networks. Group communication through a collection of agent-enabled applications that include collaboration and situation awareness has been secured on multiple layers. Secure subgroups have been created with all related key management including real-time user revocation.

[0056] The security framework uses a combination of symmetric and public-key cryptography to support encrypted communication at both the network and the agent application layers. SWAT is capable of supporting secure group

> communication, via shared key generation, for groups and sub-groups of computing hosts and agents. Security is monitored by agents that manage keys, assess network traffic patterns and analyze host behaviors. Using this framework, agents can revoke access rights for suspicious hosts or agents and adaptively re-route traffic at the network layer to improve the information integrity of the overall system. Lastly, agents provide the implementation framework for a number of decentralized user applications, including, but not limited to, those for user authentication, collaboration, messaging and remote sensor monitoring.

The Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

13. Dependent Claim 12 Independently Patentable

Notwithstanding its dependency from Independent Claim 1, Dependent Claim 12 is patentable on its own merits.

Claim 11 was rejected under 35 U.S.C. 103(a) as being unpatentabie over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al. and in further view of Regli *et al.* (2005/0141706). Applicant respectfully traverses the rejection of claim 12

Claim 1 recites:

> 1. A method comprising:
> transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

Claim 12 recites:

> 12. The method of Claim 1, wherein said transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes further comprises:
> decoding at least a part of one or more mote-addressed content indexes utilizing at least one of a public key or a private key.

The Office action, at page 9, paragraph 14, recites:

> Claims 11, 12, 23, and 24 are rejected under 35 U.S.C. 103(a) as being unpatentabie over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al. and in further view of Regli et al. (2005/0141706).

Applicant respectfully traverses the rejection of claim 12.

More specifically, the Office action, at page 10, paragraph 14, recites:

> As to claim 12, Mulgund in view of Madden shows all the elements except for decoding at least a part of one or more mote-addressed content indexes utilizing at least one of a public key or a private key. Regli shows decoding traffic

on the network layer 'decryption of traffic] utilizing at least one of a public key or a private key (paragraph [0064]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund in view of Madden by having at least a part of one or more mote-addressed content indexes (as taught by Mulgund in view of Madden) being decoded utilizing at least one of a public key or a private key (as taught by Regli) in order to support encrypted communication at the network layer between wireless devices (paragraphs [0054]-[0056] and [0064] in Regli).

Regli at paragraphs 0054-0056 and 0064 recites:

[0054] The Secure Wireless Agent Testbed (SWAT) is a live laboratory to study integration, networking and information assurance for next-generation wireless mobile agent systems. Specifically, the SWAT infrastructure comprises of PDA-based computing platforms on a wireless network with ad hoc routing. Although not shown, any type of computer, cellular telephone, digital or electronic device capable of transmitting information may be used instead of or in addition to PDA-based computing platforms. The physical network infrastructure is based on IEEE standard 802.11b wireless LAN technology or a technology similar thereto, using network interface cards, including, but not limited to, network interface cards manufactured by Cisco. The software infrastructure for SWAT is generally OpenSource: Linux Familiar OS 0.5.3 (Kernel 2.4.18), Blackdown Java 1.3.1, OpenSSL, IPSec, and EMAA; and non-OpenSource software infrastructure may be also be implemented in conjunction with or instead of the OpenSource code. The software is uniform across nodes.

[0055] An accomplishment of SWAT is the operational integration of a contributory group key generating algorithm in conjunction with a key agreement protocol, a messaging system for running the key agreement protocol and a mechanism for revoking the key from an agent, user, group, network or host, and demonstration of their purposeful use on live ad hoc routed networks. Group communication through a collection of agent-enabled applications that include collaboration and situation awareness has been secured on multiple layers. Secure subgroups have been created with all related key management including real-time user revocation.

[0056] The security framework uses a combination of symmetric and public-key cryptography to support encrypted communication at both the network and the agent application layers. SWAT is capable of supporting secure group communication, via shared key generation, for groups and sub-groups of computing hosts and agents. Security is monitored by agents that manage keys, assess network traffic patterns and analyze host behaviors. Using this framework, agents can revoke access rights for suspicious hosts or agents and adaptively re-

route traffic at the network layer to improve the information integrity of the overall system. Lastly, agents provide the implementation framework for a number of decentralized user applications, including, but not limited to, those for user authentication, collaboration, messaging and remote sensor monitoring.

[0064] SWAT addresses the need for a mobile agent information assurance framework that includes cryptography and the ability for different groups of agents to generate secure communications channels within the overall agent community. Agents must be able to reason about security groups and communications in a manner that allows them to adapt to a dynamic security environment in which hosts may become compromised, networks may get attacked, and malicious agents may need to be identified and contained. SWAT provides agents with secure multi-layer, agent-to-agent group communication on resource-constrained devices. The security framework uses a combination of symmetric and public-key cryptography to support encrypted communication at both the network and the agent application layers, including support for secure group communication. To accomplish this, established security technologies have been integrated into SWAT. SWAT is a complete integration of tools for key generation and management; secure group communication; user revocation through the use of a SEcurity Mediator (SEM); and en/decryption of traffic on the network layer. The cryptographic tools integrated in the current implementation of SWAT include: CLIQUES, the Tree Group DiffeHellman (TGDH) algorithm, Spread, Secure Spread, a SEM and IPSec.

Claim 12 recites, "decoding at least a part of one or more mote-addressed content indexes utilizing at least one of a public key or a private key." In support of the rejection, the Office action, at page 10, paragraph 14, recites:

As to claim 12, Mulgund in view of Madden shows all the elements except for decoding at least a part of one or more mote-addressed content indexes utilizing at least one of a public key or a private key. Regli shows decoding traffic on the network layer 'decryption of traffic] utilizing at least one of a public key or a private key (paragraph [0064]). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Mulgund in view of Madden by having at least a part of one or more mote-addressed content indexes (as taught by Mulgund in view of Madden) being decoded utilizing at least one of a public key or a private key (as taught by Regli) in order to support encrypted communication at the network layer between wireless devices (paragraphs [0054]-[0056] and [0064] in Regli).

Regli at paragraphs 0054-0056 and 0064 recites:

[0054] The Secure Wireless Agent Testbed (SWAT) is a live laboratory to study integration, networking and information assurance for next-generation wireless mobile agent systems. Specifically, the SWAT infrastructure comprises of PDA-based computing platforms on a wireless network with ad hoc routing. Although not shown, any type of computer, cellular telephone, digital or electronic device capable of transmitting information may be used instead of or in addition to PDA-based computing platforms. The physical network infrastructure is based on IEEE standard 802.11b wireless LAN technology or a technology similar thereto, using network interface cards, including, but not limited to, network interface cards manufactured by Cisco. The software infrastructure for SWAT is generally OpenSource: Linux Familiar OS 0.5.3 (Kernel 2.4.18), Blackdown Java 1.3.1, OpenSSL, IPSec, and EMAA; and non-OpenSource software infrastructure may be also be implemented in conjunction with or instead of the OpenSource code. The software is uniform across nodes.

[0055] An accomplishment of SWAT is the operational integration of a contributory group key generating algorithm in conjunction with a key agreement protocol, a messaging system for running the key agreement protocol and a mechanism for revoking the key from an agent, user, group, network or host, and demonstration of their purposeful use on live ad hoc routed networks. Group communication through a collection of agent-enabled applications that include collaboration and situation awareness has been secured on multiple layers. Secure subgroups have been created with all related key management including real-time user revocation.

[0056] The security framework uses a combination of symmetric and public-key cryptography to support encrypted communication at both the network and the agent application layers. SWAT is capable of supporting secure group communication, via shared key generation, for groups and sub-groups of computing hosts and agents. Security is monitored by agents that manage keys, assess network traffic patterns and analyze host behaviors. Using this framework, agents can revoke access rights for suspicious hosts or agents and adaptively re-route traffic at the network layer to improve the information integrity of the overall system. Lastly, agents provide the implementation framework for a number of decentralized user applications, including, but not limited to, those for user authentication, collaboration, messaging and remote sensor monitoring.

[0064] SWAT addresses the need for a mobile agent information assurance framework that includes cryptography and the ability for different groups of agents to generate secure communications channels within the overall agent community. Agents must be able to reason about security groups and communications in a manner that allows them to adapt to a dynamic security environment in which hosts may become compromised, networks may get attacked, and malicious agents may need to be identified and contained. SWAT provides agents with secure multi-layer, agent-to-agent group communication on

> resource-constrained devices. The security framework uses a combination of symmetric and public-key cryptography to support encrypted communication at both the network and the agent application layers, including support for secure group communication. To accomplish this, established security technologies have been integrated into SWAT. SWAT is a complete integration of tools for key generation and management; secure group communication; user revocation through the use of a SEcurity Mediator (SEM); and en/decryption of traffic on the network layer. The cryptographic tools integrated in the current implementation of SWAT include: CLIQUES, the Tree Group DiffeHellman (TGDH) algorithm, Spread, Secure Spread, a SEM and IPSec.

However, in contrast to the recitations of claim 12, the recitations from Regli *et al.* fail to recite, "decoding at least a part of one or more mote-addressed content indexes utilizing at least one of a public key or a private key." Further, Regli *et al.* fails to recite, "decoding." Still further, based on an analysis of the Office action, the above quoted recitation from Regli *et al.* and claim 12, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Regli *et al.* with the recitation of claim 12,
"decoding at least a part of one or more mote-addressed content indexes utilizing at least one of a public key or a private key." Hence, the Office action fails to show how Regli *et al.* teach or suggest, "decoding at least a part of one or more mote-addressed content indexes utilizing at least one of a public key or a private key." Thus, the Office action fails to state a *prima facie* case of obviousness with respect to claim 12. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 12.

Further, the Office action fails to supply citation to a teaching, suggestion, or motivation in the citations that support the combination of documents. Thus, Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Regli *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 12, the Office action still fails to state a *prima facie* case

of obviousness with respect to claim 12. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 12.

As the Office action provides no recitation as to the reasons for the obviousness of the combination, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

14. Independent Claim 25

Claim 25 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et al.* Applicant respectfully traverses the rejection of claim 25.

Claim 25 recites:

> 25. A system comprising:
> a mote; and
> means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to a portion of said mote.

The Office action, at page 10, paragraph 15, recites:

> Claims 25, 26, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo et al.

More specifically, the Office action at page 11, paragraph 15, recites:

> As to claim 25, Mulgund shows a mote (Fig. 1 node (2)). Mulgund does not explicitly show means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to said mote.
>
> Madden shows means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to said mote [a TinyOS that facilitates routing data from child device to a parent device] (section 1 Introduction).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund by having means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to said mote in order to facilitate routing data between devices (Madden, section 1).

In support to the teaching of Madden, Woo shows a complete TinyOS application component graph wherein the sensor component periodically transmits the data toward a base station over the muttihop [sic] network (section 2.1 Networking Component Stack).

Madden in section 1 Introduction recites:

In the past few years, smart sensor devices have matured to the point that it is now feasible to deploy large, distributed networks of such sensors [42, 23, 37, 8]. Sensor networks are differentiated from other wireless, battery-powered environments in that they consist of tens or hundreds of autonomous nodes that operate without human interaction (e.g. configuration of network routes, recharging of batteries, or tuning of parameters) for weeks or months at a time. Furthermore, sensor networks are often embedded into some (possibly remote) physical environment from which they must monitor and collect data. The long-term, low-power nature of sensor networks, coupled with their proximity to physical phenomena, lead to a significantly altered view of software systems than that of more traditional mobile or distributed environments.
In this paper, we are concerned with query processing in sensor networks. Researchers have noted the benefits of a query processor-like interface to sensor networks and the need for sensitivity to limited power and computational resources [27, 33, 41, 48, 34]. Prior systems, however, tend to view query processing in sensor networks simply as a power-constrained version of traditional query processing: given some set of data, they strive to process that data as energy-efficiently as possible. Typical strategies include minimizing expensive communication by applying aggregation and filtering operations inside the sensor network
strategies that are familiar from push-down techniques from distributed query processing that emphasize moving queries to data.

In contrast, we present acquisitional query processing (ACQP), where we focus on the significant new query processing opportunity that arises in sensor networks: the fact that smart sensors have control over where, when, and how often data is physically acquired (i.e. sampled) and delivered to query processing operators. By focusing on the locations and costs of acquiring data, we are able to significantly reduce power consumption compared to traditional passive systems that assume the a priori existence of data. Acquisitional issues arise at all levels of query processing: in query optimization, due to the significant costs of sampling sensors; in query dissemination, due to the physical co-location of sampling and processing; and, most importantly, in query execution, where choices of when to sample and which samples to process are made. Of course, techniques proposed in other research on sensor and power-constrained query processing, such as pushing

down predicates and minimizing communication are also important alongside ACQP and fit comfortably within its model.

We have designed and implemented an ACQP engine, called TinyDB (for more information on TinyDB, see [35]), which is a distributed query processor that runs on each of the nodes in a sensor network. TinyDB runs on the Berkeley Mica mote platform, on top of the TinyOS [23] operating system. We chose this platform because the hardware is readily available from commercial sources [13] and the operating system is relatively mature. TinyDB has many of the features of a traditional query processor (e.g. the ability to select, join, project, and aggregate data), but, as we will discuss in this paper, also incorporates a number of other features designed to minimize power consumption via acquisitional techniques. These techniques, taken in aggregate, can lead to orders of magnitude improvement in power consumption and increased accuracy of query results over non-acquisitional systems that do not actively control when and where data is collected.

We address a number of ACQP-related questions, including:

1. When should samples for a particular query be taken?
2. What sensor nodes have data relevant to a particular query?
3. In what order should samples for this query be taken, and how should sampling be interleaved with other operations?
4. Is it worth expending computational power or bandwidth to process and relay a particular sample?

Of these issues, question (1) is unique to ACQP. The remaining questions can be answered by adapting techniques that are similar to those found in traditional query processing. Notions of indexing and optimization, in particular, can be applied to answer questions (2) and (3), and question (4) bears some similarity to issues that arise in stream processing and approximate query answering. We will address each of these questions, noting the unusual kinds of indices, optimizations, and approximations that are required in ACQP under the specific constraints posed by sensor networks.

Figure 1 illustrates the basic architecture that we follow throughout this paper — queries are submitted at a powered PC (the base station), parsed, optimized and sent into the sensor network, where they are disseminated and processed, with results flowing back up the routing tree that was formed as the queries propagated. After a brief introduction to sensor networks in Section 2, the remainder of the paper discusses each of these phases of ACQP: Section 3 covers our query language, Section 4 highlights optimization issues in power-sensitive environments, Section 5 discusses query dissemination, and finally, Sections 6 discusses our adaptive, power-sensitive model for query execution and result collection.

Section 2.1 of Woo recites:

TinyOS [7] is an event-based operating system for these devices that provides fine-grained interleaving of event processing and tasks from multiple system components. The complete TinyOS application for our study is shown in Figure 2.

> There is a component providing an asynchronous interface to each sensor and a stack of components to implement networking over the radio. The lowest layer transmits or receives bytes bit-by-bit over the radio. It provides phase and rate controls to lock on to the packet start symbol and then to spool bits. At this level, the interface is half-duplex - the radio is receiving except during packet transmission. The packet-level component is responsible for spooling incoming bytes and delivering the packet receive event. It is where the media access control mechanisms for transmit reside. (It also performs the encoding and decoding of the byte stream onto the link and error checking: Manchester encoding with an 16-bit CRC.) Packets are short and of a fixed size, typically 30 bytes including an one byte destination field, an one byte handler field, and an application data unit. The Active Message component delivers tagged packet events to application level components. Here we have two such components. The sensor component periodically receives a clock event, acquires sensor data, and transmits the data toward a base station over the multihop network. The other component is responsible for building the dynamic multi-hop network and routing traffic. A simple beacon-based discovery protocol maintains a breadth-first spanning tree, such that each node knows a "parent node" closer to the base station. Originating sensor packets are marked for the parent. (All other nodes discard them.) At each hop, the multihop component receives a packet and retransmits it to the upstream level. In general, this component might perform aggregation or statistical analysis. However, we restrict ourselves to the case where it forwards all data to the infrastructure for analysis, as this focuses the work on the media access and transmission control aspects. This component does collect statistics on the number of nodes routing through it. The only buffering in the system is a fixed number of small packet buffers at the application level, one of which is used for the asynchronous receive. Thus, if the radio is busy transmitting or receiving when a packet send is requested, the request will fail back up to the application component. Once the packet component has accepted a packet for transmission, it will work on it until it acquires the channel and transmits it. Thus, the transmission rate control is implemented within the two application components.

Claim 25 recites, "means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to a portion of said mote."

The Office action, in the rejection of claim 25 cites to Madden in section 1 Introduction:

> In the past few years, smart sensor devices have matured to the point that it is now feasible to deploy large, distributed networks of such sensors [42, 23, 37, 8]. Sensor networks are differentiated from other wireless, battery-powered environments in that they consist of tens or hundreds of autonomous nodes that operate without human interaction (e.g. configuration of network routes,

recharging of batteries, or tuning of parameters) for weeks or months at a time. Furthermore, sensor networks are often embedded into some (possibly remote) physical environment from which they must monitor and collect data. The long-term, low-power nature of sensor networks, coupled with their proximity to physical phenomena, lead to a significantly altered view of software systems than that of more traditional mobile or distributed environments.

In this paper, we are concerned with query processing in sensor networks. Researchers have noted the benefits of a query processor-like interface to sensor networks and the need for sensitivity to limited power and computational resources [27, 33, 41, 48, 34]. Prior systems, however, tend to view query processing in sensor networks simply as a power-constrained version of traditional query processing: given some set of data, they strive to process that data as energy-efficiently as possible. Typical strategies include minimizing expensive communication by applying aggregation and filtering operations inside the sensor network

strategies that are familiar from push-down techniques from distributed query processing that emphasize moving queries to data.

In contrast, we present acquisitional query processing (ACQP), where we focus on the significant new query processing opportunity that arises in sensor networks: the fact that smart sensors have control over where, when, and how often data is physically acquired (i.e. sampled) and delivered to query processing operators. By focusing on the locations and costs of acquiring data, we are able to significantly reduce power consumption compared to traditional passive systems that assume the a priori existence of data. Acquisitional issues arise at all levels of query processing: in query optimization, due to the significant costs of sampling sensors; in query dissemination, due to the physical co-location of sampling and processing; and, most importantly, in query execution, where choices of when to sample and which samples to process are made. Of course, techniques proposed in other research on sensor and power-constrained query processing, such as pushing down predicates and minimizing communication are also important alongside ACQP and fit comfortably within its model.

We have designed and implemented an ACQP engine, called TinyDB (for more information on TinyDB, see [35]), which is a distributed query processor that runs on each of the nodes in a sensor network. TinyDB runs on the Berkeley Mica mote platform, on top of the TinyOS [23] operating system. We chose this platform because the hardware is readily available from commercial sources [13] and the operating system is relatively mature. TinyDB has many of the features of a traditional query processor (e.g. the ability to select, join, project, and aggregate data), but, as we will discuss in this paper, also incorporates a number of other features designed to minimize power consumption via acquisitional techniques. These techniques, taken in aggregate, can lead to orders of magnitude improvement in power consumption and increased accuracy of query results over non-acquisitional systems that do not actively control when and where data is collected.

We address a number of ACQP-related questions, including:

1. When should samples for a particular query be taken?

2. What sensor nodes have data relevant to a particular query?

3. In what order should samples for this query be taken, and how should sampling be interleaved with other operations?

4. Is it worth expending computational power or bandwidth to process and relay a particular sample?

Of these issues, question (1) is unique to ACQP. The remaining questions can be answered by adapting techniques that are similar to those found in traditional query processing. Notions of indexing and optimization, in particular, can be applied to answer questions (2) and (3), and question (4) bears some similarity to issues that arise in stream processing and approximate query answering. We will address each of these questions, noting the unusual kinds of indices, optimizations, and approximations that are required in ACQP under the specific constraints posed by sensor networks.

Figure 1 illustrates the basic architecture that we follow throughout this paper — queries are submitted at a powered PC (the base station), parsed, optimized and sent into the sensor network, where they are disseminated and processed, with results flowing back up the routing tree that was formed as the queries propagated. After a brief introduction to sensor networks in Section 2, the remainder of the paper discusses each of these phases of ACQP: Section 3 covers our query language, Section 4 highlights optimization issues in power-sensitive environments, Section 5 discusses query dissemination, and finally, Sections 6 discusses our adaptive, power-sensitive model for query execution and result collection.

However, in contrast to the recitations of claim 25, the recitations from Madden *et al.* fail to recite, "means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to a portion of said mote." Further, Madden *et al.* fail to recite "one or more mote-addressed content indexes," as recited in claim 25. Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 25, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Mulgund *et al.* with the recitation of claim 25, " means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to a portion of said mote." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to a portion of said mote." Thus, the Office action fails to state

a *prima facie* case of anticipation with respect to claim 25. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 25.

Further, the Office action, recites:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund by having means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to said mote in order to facilitate routing data between devices (Madden, section 1).

Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

As the Office action provides no support for the statement that the combination is obvious to one of ordinary skill in the art (i.e., the recitations of Madden *et al.* fail to recite "content indexes" or "transmitting . . . content indexes. . . ", or explain how the combined teachings teach or suggest "content indexes" or "transmitting . . . content indexes. . . ," and therefore do not support the conclusion that the combination is obvious), applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

15. Independent Claim 26

Claim 26 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et al.* Applicant respectfully traverses the rejection of claim 26.

Claim 26 recites:

> 26. A system comprising:
> at least one mote; and
> at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index.

The Office action, at page 10, paragraph 15, recites:

> Claims 25, 26, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo et al.

More specifically, the Office action at page 10, paragraph 15 recites:

> As to claim 26, Mulgund shows a mote (Fig. 1 node (2)). Mulgund does not explicitly show at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index.
>
> Madden shows at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index [a TinyOS that facilitates routing data from child device to a parent device] (section 1 Introduction).
>
> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund by having at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote

reporting entity configured to report at least a part of a multi-mote content index in order to facilitate routing data between devices (Madden, section 1).

In support to the teaching of Madden, Woo shows a complete TinyOS application component graph wherein the sensor component periodically transmits the data toward a base station over the multihop network (section 2.1 Networking Component Stack).

Madden in section 1 Introduction recites:

In the past few years, smart sensor devices have matured to the point that it is now feasible to deploy large, distributed networks of such sensors [42, 23, 37, 8]. Sensor networks are differentiated from other wireless, battery-powered environments in that they consist of tens or hundreds of autonomous nodes that operate without human interaction (e.g. configuration of network routes, recharging of batteries, or tuning of parameters) for weeks or months at a time. Furthermore, sensor networks are often embedded into some (possibly remote) physical environment from which they must monitor and collect data. The long-term, low-power nature of sensor networks, coupled with their proximity to physical phenomena, lead to a significantly altered view of software systems than that of more traditional mobile or distributed environments.
In this paper, we are concerned with query processing in sensor networks. Researchers have noted the benefits of a query processor-like interface to sensor networks and the need for sensitivity to limited power and computational resources [27, 33, 41, 48, 34]. Prior systems, however, tend to view query processing in sensor networks simply as a power-constrained version of traditional query processing: given some set of data, they strive to process that data as energy-efficiently as possible. Typical strategies include minimizing expensive communication by applying aggregation and filtering operations inside the sensor network
strategies that are familiar from push-down techniques from distributed query processing that emphasize moving queries to data.

In contrast, we present acquisitional query processing (ACQP), where we focus on the significant new query processing opportunity that arises in sensor networks: the fact that smart sensors have control over where, when, and how often data is physically acquired (i.e. sampled) and delivered to query processing operators. By focusing on the locations and costs of acquiring data, we are able to significantly reduce power consumption compared to traditional passive systems that assume the a priori existence of data. Acquisitional issues arise at all levels of query processing: in query optimization, due to the significant costs of sampling sensors; in query dissemination, due to the physical co-location of sampling and processing; and, most importantly, in query execution, where choices of when to sample and which samples to process are made. Of course, techniques proposed in other research on sensor and power-constrained query processing, such as pushing down predicates and minimizing communication are also important alongside ACQP and fit comfortably within its model.

We have designed and implemented an ACQP engine, called TinyDB (for more information on TinyDB, see [35]), which is a distributed query processor that runs on each of the nodes in a sensor network. TinyDB runs on the Berkeley Mica mote platform, on top of the TinyOS [23] operating system. We chose this platform because the hardware is readily available from commercial sources [13] and the operating system is relatively mature. TinyDB has many of the features of a traditional query processor (e.g. the ability to select, join, project, and aggregate data), but, as we will discuss in this paper, also incorporates a number of other features designed to minimize power consumption via acquisitional techniques. These techniques, taken in aggregate, can lead to orders of magnitude improvement in power consumption and increased accuracy of query results over non-acquisitional systems that do not actively control when and where data is collected.

We address a number of ACQP-related questions, including:

1. When should samples for a particular query be taken?
2. What sensor nodes have data relevant to a particular query?
3. In what order should samples for this query be taken, and how should sampling be interleaved with other operations?
4. Is it worth expending computational power or bandwidth to process and relay a particular sample?

Of these issues, question (1) is unique to ACQP. The remaining questions can be answered by adapting techniques that are similar to those found in traditional query processing. Notions of indexing and optimization, in particular, can be applied to answer questions (2) and (3), and question (4) bears some similarity to issues that arise in stream processing and approximate query answering. We will address each of these questions, noting the unusual kinds of indices, optimizations, and approximations that are required in ACQP under the specific constraints posed by sensor networks.

Figure 1 illustrates the basic architecture that we follow throughout this paper — queries are submitted at a powered PC (the base station), parsed, optimized and sent into the sensor network, where they are disseminated and processed, with results flowing back up the routing tree that was formed as the queries propagated. After a brief introduction to sensor networks in Section 2, the remainder of the paper discusses each of these phases of ACQP: Section 3 covers our query language, Section 4 highlights optimization issues in power-sensitive environments, Section 5 discusses query dissemination, and finally, Sections 6 discusses our adaptive, power-sensitive model for query execution and result collection.

Section 2.1 of Woo recites:

TinyOS [7] is an event-based operating system for these devices that provides fine-grained interleaving of event processing and tasks from multiple system components. The complete TinyOS application for our study is shown in Figure 2. There is a component providing an asynchronous interface to each sensor and a stack of components to implement networking over the radio. The lowest layer

transmits or receives bytes bit-by-bit over the radio. It provides phase and rate controls to lock on to the packet start symbol and then to spool bits. At this level, the interface is half-duplex - the radio is receiving except during packet transmission. The packet-level component is responsible for spooling incoming bytes and delivering the packet receive event. It is where the media access control mechanisms for transmit reside. (It also performs the encoding and decoding of the byte stream onto the link and error checking: Manchester encoding with an 16-bit CRC.) Packets are short and of a fixed size, typically 30 bytes including an one byte destination field, an one byte handler field, and an application data unit. The Active Message component delivers tagged packet events to application level components. Here we have two such components. The sensor component periodically receives a clock event, acquires sensor data, and transmits the data toward a base station over the multihop network. The other component is responsible for building the dynamic multi-hop network and routing traffic. A simple beacon-based discovery protocol maintains a breadth-first spanning tree, such that each node knows a "parent node" closer to the base station. Originating sensor packets are marked for the parent. (All other nodes discard them.) At each hop, the multihop component receives a packet and retransmits it to the upstream level. In general, this component might perform aggregation or statistical analysis. However, we restrict ourselves to the case where it forwards all data to the infrastructure for analysis, as this focuses the work on the media access and transmission control aspects. This component does collect statistics on the number of nodes routing through it. The only buffering in the system is a fixed number of small packet buffers at the application level, one of which is used for the asynchronous receive. Thus, if the radio is busy transmitting or receiving when a packet send is requested, the request will fail back up to the application component. Once the packet component has accepted a packet for transmission, it will work on it until it acquires the channel and transmits it. Thus, the transmission rate control is implemented within the two application components.

Claim 26 recites, "at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index."

The Office action, in the rejection of claim 26 cites to Madden in section 1 Introduction:

In the past few years, smart sensor devices have matured to the point that it is now feasible to deploy large, distributed networks of such sensors [42, 23, 37, 8]. Sensor networks are differentiated from other wireless, battery-powered environments in that they consist of tens or hundreds of autonomous nodes that operate without human interaction (e.g. configuration of network routes, recharging of batteries, or tuning of parameters) for weeks or months at a time. Furthermore, sensor networks are often embedded into some (possibly remote)

physical environment from which they must monitor and collect data. The long-term, low-power nature of sensor networks, coupled with their proximity to physical phenomena, lead to a significantly altered view of software systems than that of more traditional mobile or distributed environments.

In this paper, we are concerned with query processing in sensor networks. Researchers have noted the benefits of a query processor-like interface to sensor networks and the need for sensitivity to limited power and computational resources [27, 33, 41, 48, 34]. Prior systems, however, tend to view query processing in sensor networks simply as a power-constrained version of traditional query processing: given some set of data, they strive to process that data as energy-efficiently as possible. Typical strategies include minimizing expensive communication by applying aggregation and filtering operations inside the sensor network

strategies that are familiar from push-down techniques from distributed query processing that emphasize moving queries to data.

In contrast, we present acquisitional query processing (ACQP), where we focus on the significant new query processing opportunity that arises in sensor networks: the fact that smart sensors have control over where, when, and how often data is physically acquired (i.e. sampled) and delivered to query processing operators. By focusing on the locations and costs of acquiring data, we are able to significantly reduce power consumption compared to traditional passive systems that assume the a priori existence of data. Acquisitional issues arise at all levels of query processing: in query optimization, due to the significant costs of sampling sensors; in query dissemination, due to the physical co-location of sampling and processing; and, most importantly, in query execution, where choices of when to sample and which samples to process are made. Of course, techniques proposed in other research on sensor and power-constrained query processing, such as pushing down predicates and minimizing communication are also important alongside ACQP and fit comfortably within its model.

We have designed and implemented an ACQP engine, called TinyDB (for more information on TinyDB, see [35]), which is a distributed query processor that runs on each of the nodes in a sensor network. TinyDB runs on the Berkeley Mica mote platform, on top of the TinyOS [23] operating system. We chose this platform because the hardware is readily available from commercial sources [13] and the operating system is relatively mature. TinyDB has many of the features of a traditional query processor (e.g. the ability to select, join, project, and aggregate data), but, as we will discuss in this paper, also incorporates a number of other features designed to minimize power consumption via acquisitional techniques. These techniques, taken in aggregate, can lead to orders of magnitude improvement in power consumption and increased accuracy of query results over non-acquisitional systems that do not actively control when and where data is collected.

We address a number of ACQP-related questions, including:

1. When should samples for a particular query be taken?
2. What sensor nodes have data relevant to a particular query?

> 3. In what order should samples for this query be taken, and how should sampling be interleaved with other operations?
> 4. Is it worth expending computational power or bandwidth to process and relay a particular sample?
>
> Of these issues, question (1) is unique to ACQP. The remaining questions can be answered by adapting techniques that are similar to those found in traditional query processing. Notions of indexing and optimization, in particular, can be applied to answer questions (2) and (3), and question (4) bears some similarity to issues that arise in stream processing and approximate query answering. We will address each of these questions, noting the unusual kinds of indices, optimizations, and approximations that are required in ACQP under the specific constraints posed by sensor networks.
>
> Figure 1 illustrates the basic architecture that we follow throughout this paper — queries are submitted at a powered PC (the base station), parsed, optimized and sent into the sensor network, where they are disseminated and processed, with results flowing back up the routing tree that was formed as the queries propagated. After a brief introduction to sensor networks in Section 2, the remainder of the paper discusses each of these phases of ACQP: Section 3 covers our query language, Section 4 highlights optimization issues in power-sensitive environments, Section 5 discusses query dissemination, and finally, Sections 6 discusses our adaptive, power-sensitive model for query execution and result collection.

However, in contrast to the recitations of claim 26, the recitations from Madden *et al.* fail to recite, "at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index." Further, Madden *et al.* fail to recite "a multi-mote content index," as recited in claim 26. Still further, based on an analysis of the Office action, the above quoted recitation from Madden *et al.* and claim 26, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Mulgund *et al.* with the recitation of claim 26, "at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index." Hence, the Office action fails to show how Madden *et al.* teach or suggest, "at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index." Thus, the Office action fails to state a *prima facie* case of anticipation with respect to claim 26. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 26.

Further, the Office action, recites:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund by having means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to said mote in order to facilitate routing data between devices (Madden, section 1).

Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.* and Madden *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

As the Office action provides no support for the statement that the combination is obvious to one of ordinary skill in the art (i.e., the recitations of Madden *et al.*, section 1 fail to recite "a multi-mote content index", or explain how the combined teachings teach or suggest "a multi-mote content index" and therefore do not support the conclusion that the combination is obvious), applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

16. Dependent Claims 27-29 Patentable for at Least Reasons of Dependency from Independent Claim 26

Claims 27-29 depend either directly or indirectly from Independent Claim 26. "A claim in dependent form shall be construed to incorporate by reference all the limitations of the claim to which it refers." See 35 U.S.C. § 112 paragraph 4. Consequently, Dependent Claims 27-29 are patentable for at least the reasons why Independent Claim 26 is patentable. Accordingly, Applicant respectfully requests that Examiner hold Dependent Claims 27-29 patentable for at least the foregoing reasons, and issue a Notice of Allowability on same.

17. Dependent Claim 27 Independently Patentable

Notwithstanding its dependency from Dependent Claim 26, Dependent Claim 27 is patentable on its own merits.

Claim 27 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et at* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* in view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et at* and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 27.

Claim 26 recites:

> 26. A system comprising:
> at least one mote; and
> at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index.

Claim 27 recites:

> 27. The system of Claim 26, wherein said multi-mote content index further comprises:
> at least one of a sensing function, a control function, or routing/spatial information of a mote-appropriate device.

The Office action, at page 12, paragraph 16, recites:

> Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et at (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al. (hereinafter Madden Ref. 1) in view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo et at and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden et al. (hereinafter Madden Ref. 2).

More specifically, the Office action at page 13, paragraph 16, recites:

> As to claim 27, Mulgund shows that said multi-mote content index comprises at least one of a sensing function, a control function, or a routing/spatial information of a mote-appropriate device (paragraphs [0037], [0041] in Mulgund).
>
> Alternatively, Madden Ref. 2 shows that said multi-mote content index comprises at least one of a sensing function, a control function, or a routing/spatial information of a mote-appropriate device (under 2.2 Communication in Sensor Networks, paragraph 2).
>
> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund in view of Madden Ref. 1 and further view of Woo by having said multi-mote content index comprises at least one of a sensing function, a control function, or a routing/spatial information of a mote-appropriate device in order to provide mote specific information.

Mulgund at paragraphs 0037 and 0041 recites:

[0037] The Nodes Table 20 maintains a list of all known sensor nodes 2 in the network 4. Each node is identified by a unique Node Address, which is a primary key for the Nodes Table 20. The Nodes Table also contains a Status field, which is used to indicate whether a node is known to be active. This field is used for marking nodes that have disappeared from the network (which could later reappear). At present, it is anticipated that this Status variable will take on one of just a small set of mutually exclusive values that indicate whether or not the associated node continues to be an active, reachable member of the network 4. Finally, the Nodes Table 20 contains a Timestamp field that indicates when the Status information was last updated. When a node disappears from the network for whatever reason, the corresponding entry in the Nodes Table 20 is not deleted; it is marked as unreachable. The reason for doing so is explained below.

[0041] FIG. 3 illustrates the simplest case, wherein each node 2 generates n well-defined sensor data signals. The composite primary key for the Sensor Data Table 24 is the identity of the Node Address and a Timestamp, followed by n individual sensor data outputs. This ensures that the only allowable entries are for known nodes, and that only one entry can be made per node at a given time instant. In this simple case, all Sensor Data is stored in the same Sensor Data Table 24. Each node may have a unique internal sampling rate, and the node itself may be sampled by the database server 10 at different rates; no assumptions are made about these operations. The relationship between this Sensor Data Table 24 and Nodes Table 20 illustrates why entries on individual nodes are not deleted from the Nodes table when they become unreachable: access to historical sensor data

from past members of the network is preferred, even if those members are no longer present.

Madden at section 2.2, paragraph 2 recites:

The requirement that sensor networks be low maintenance and easy to deploy means that communication topologies must be automatically discovered (i.e. ad-hoc) by the devices rather than fixed at the time of
current load of a sensor, because current is easy to measure directly; note that power (in Watts) = current (in Amps) * voltage (in Volts), and that Mica motes run at 3V. network deployment. Typically, devices keep a short list of neighbors who they have heard transmit recently, as well as some routing information about the connectivity of those neighbors to the rest of the network. To assist in making intelligent routing decisions, nodes associate a link quality with each of their neighbors.

Claim 27 recites, "wherein said multi-mote content index further comprises: at least one of a sensing function, a control function, or routing/spatial information of a mote-appropriate device." The Office action, in rejection claim 27 cites to paragraphs 0025 and 0062 of Mulgund *et al.*:

[0025] It is of no concern how this network topology came into being, how it is organized, what routing algorithms are used to pass messages from one node to the next, but rather, how to aggregate the information at each of the nodes into an off-network repository or network model database 12. The sensing nodes 2 may be mobile, and the interconnections may change over time. Furthermore, new nodes may join the network 4 at any time, and existing nodes may leave the network unexpectedly.

[0062] The traversal process begins at node A 32. Node A 32 is visited and pushed onto the stack. The process of visiting a node involves retrieving the information stored at the node, and updating the local database.

However, in contrast to the recitations of claim 27, the recitations from Mulgund *et al.* fail to recite, "wherein said multi-mote content index further comprises: at least one of a sensing function, a control function, or routing/spatial information of a mote-appropriate device." Further, based on an analysis of the Office action, the above quoted recitation from Mulgund *et al.* and claim 27, Applicant respectfully submits that the Office action has supplied no text,

reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Mulgund *et al.* with the recitation of claim 27, " wherein said multi-mote content index further comprises: at least one of a sensing function, a control function, or routing/spatial information of a mote-appropriate device." Hence, the Office action fails to show how Mulgund *et al.* teach or suggest, " wherein said multi-mote content index further comprises: at least one of a sensing function, a control function, or routing/spatial information of a mote-appropriate device." Thus, the Office action fails to state a *prima facie* case of anticipation with respect to claim 27. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 27.

Further, the Office action, recites:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund in view of Madden Ref. 1 and further view of Woo by having said multi-mote content index comprises at least one of a sensing function, a control function, or a routing/spatial information of a mote-appropriate device in order to provide mote specific information.

Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.*, Madden *et al.*, or Woo *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 27, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 27. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 27.

As the Office action provides no support for the statement that the combination is obvious to one of ordinary skill in the art, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner

must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

18. Dependent Claim 28 Independently Patentable

Notwithstanding its dependency from Dependent Claim 26, Dependent Claim 28 is patentable on its own merits.

Claim 28 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et at* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden *et al.* in view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et at* and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden *et al.* Applicant respectfully traverses the rejection of claim 28.

Claim 26 recites:

> 26. A system comprising:
> at least one mote; and
> at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index.

Claim 28 recites:

> 28. The system of Claim 26, wherein said at least one multi-mote reporting entity further comprises:
> a processor configured to transmit at least one of a sensing function, a control function, or routing/spatial information.

The Office action, at page 12, paragraph 16, recites:

> Claims 27 and 28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et at (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al. (hereinafter Madden Ref. 1) in view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo et at and in further view of "The Design of an Acquisitional Query Processor For Sensor Networks" by Samuel Madden et al. (hereinafter Madden Ref. 2).

More specifically, the Office action, at page 13, paragraph 16, recites:

> As to claim 28, Mulgund in view of Madden Ref. 1 and in further view of Woo show all the elements except for a processor configured to transmit at least one of a sensing function, a control function, or a routing/spatial information
>
> Madden Ref. 2 shows a processor configured to obtain at least a sensing function of the mote (section 2.1 Properties of Sensor Devices, paragraph 2 in Madden).
>
> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund in view of Madden Ref. 1 and in view of Woo by having a processor in order to process sensor data that is being stored in a knowledge base (Fig. 2 in Mulgund).

Madden at section 2.1, paragraph 2 recites:

> Mica motes have a 4Mhz, 8bit Atmel microprocessor. Their RFM TRI000 radios run at 40 kbits/second over a single shared CSMA channel. Radio messages are variable size. Typically about 10 48-byte messages (the default size in TinyDB) can be delivered per second. Power consumption tends to be dominated by radio communication. When powered on, radios consume about as much power as the processor. However, because communication is so slow, every bit of data transmitted by the radio costs as much energy as executing 1000 CPU instructions. As an additional feature, motes have an external 32kHz clock that the TinyOS operating system can synchronize with neighboring motes +/- 1 ms to ensure that neighbors will be powered up and listening when they wish to send a message[15].

Claim 28 recites, "wherein said at least one multi-mote reporting entity further comprises: a processor configured to transmit at least one of a sensing function, a control function, or routing/spatial information."

The Office action, in rejection claim 28 cites to paragraphs 0025 and 0062 of Mulgund *et al.*:

> [0025] It is of no concern how this network topology came into being, how it is organized, what routing algorithms are used to pass messages from one node to the next, but rather, how to aggregate the information at each of the nodes into an off-network repository or network model database 12. The sensing nodes 2 may be mobile, and the interconnections may change over time. Furthermore, new nodes may join the network 4 at any time, and existing nodes may leave the network unexpectedly.

> [0062] The traversal process begins at node A 32. Node A 32 is visited and pushed onto the stack. The process of visiting a node involves retrieving the information stored at the node, and updating the local database.

However, in contrast to the recitations of claim 28, the recitations from Mulgund *et al.* fail to recite, " wherein said at least one multi-mote reporting entity further comprises: a processor configured to transmit at least one of a sensing function, a control function, or routing/spatial information." Further, based on an analysis of the Office action, the above quoted recitation from Mulgund *et al.* and claim 28, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Mulgund *et al.* with the recitation of claim 28, "wherein said at least one multi-mote reporting entity further comprises: a processor configured to transmit at least one of a sensing function, a control function, or routing/spatial information." Hence, the Office action fails to show how Mulgund *et al.* teach or suggest, "wherein said at least one multi-mote reporting entity further comprises: a processor configured to transmit at least one of a sensing function, a control function, or routing/spatial information." Thus, the Office action fails to state a *prima facie* case of anticipation with respect to claim 28. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 28.

Further, the Office action, recites:

> It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Mulgund in view of Madden Ref. 1 and in view of Woo by having a processor in order to process sensor data that is being stored in a knowledge base (Fig. 2 in Mulgund).

Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.*, Madden *et al.*, or Woo *et al.* as required under _*In re*_ _Sang Su Lee:_

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor

taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 28, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 28. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 28.

As the Office action provides no support for the statement that the combination is obvious to one of ordinary skill in the art, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth specific factual statements and explanation to support the conclusion that the combination is obvious.

19. Dependent Claim 29 Independently Patentable

Notwithstanding its dependency from Dependent Claim 26, Dependent Claim 29 is patentable on its own merits.

Claim 29 was rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund *et al.* (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo *et al.* Applicant respectfully traverses the rejection of claim 29.

Claim 26 recites:

> 26. A system comprising:
> at least one mote; and
> at least one multi-mote reporting entity resident in said at least one mote, said at least one multi-mote reporting entity configured to report at least a part of a multi-mote content index.

Claim 29 recites:

> 29. The system of Claim 26, wherein said at least one mote comprises:
> at least one of a processor, a memory, or a communications device formed from a substrate.

The Office action, at page 10, paragraph 15, recites:

> Claims 25, 26, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mulgund et al. (2002/0161751) in view of "TAG: a Tiny Aggregation Service for Ad-Hoc Sensor Networks" by Samuel Madden et al and in further view of "A Transmission Control Scheme for Media Access in Sensor Networks" by Alec Woo et al.

More specifically, the Office action at page 11 and page 12, paragraph 15, recites:

As to claim 29, Mulgund shows at least one of a processor, a memory, or a communications devices formed from a substrate (paragraph [0026]).

Mulgund at paragraph 0026 recites:

> [0026] FIG. 2 illustrates the nature of each of the sensing nodes 2, which comprise computational devices (possibly ranging in complexity from small embedded platforms to a fully-fledged PCs) that have one or more sensors 16 providing high-value information connected to it. The term sensor is used here in a general sense. A sensor 16 as contemplated herein could be as simple as an instrument that measures temperature, pressure, or any such other physical quantity. It could also be a device as complex as a video camera providing continuous full-motion imagery of some area of interest. In any case, the output of each of these sensors 16 is stored locally in a well-defined knowledge base 18, but the output can be accessed from outside the network 4 through some software application programming interface (API) and hardware implementation. Each of the sensing nodes 2 is additionally in communication with one or more other sensing nodes through connecting links 3.

Claim 29 recites, "wherein said at least one mote comprises: at least one of a processor, a memory, or a communications device formed from a substrate."

The Office action, in support of the rejection, cites to Mulgund *et al.* at paragraph 0026 recites:

> [0026] FIG. 2 illustrates the nature of each of the sensing nodes 2, which comprise computational devices (possibly ranging in complexity from small embedded platforms to a fully-fledged PCs) that have one or more sensors 16 providing high-value information connected to it. The term sensor is used here in a general sense. A sensor 16 as contemplated herein could be as simple as an instrument that measures temperature, pressure, or any such other physical quantity. It could also be a device as complex as a video camera providing continuous full-motion imagery of some area of interest. In any case, the output of each of these sensors 16 is stored locally in a well-defined knowledge base 18, but the output can be accessed from outside the network 4 through some software application programming interface (API) and hardware implementation. Each of the sensing nodes 2 is additionally in communication with one or more other sensing nodes through connecting links 3.

However, in contrast to the recitations of claim 29, the recitations from Mulgund *et al.* fail to recite, "wherein said at least one mote comprises: at least one of a processor, a memory, or a communications device formed from a substrate." Further, Mulgund et al. fails to recite "substrate." Still further, based on an analysis of the Office action, the above quoted recitation from Mulgund *et al.* and claim 29, Applicant respectfully submits that the Office action has supplied no text, reference, or knowledge explaining why one skilled in the art should equate the above quoted material from Mulgund *et al.* with the recitation of claim 29, "wherein said at least one mote comprises: at least one of a processor, a memory, or a communications device formed from a substrate." Hence, the Office action fails to show how Mulgund *et al.* teach or suggest, "wherein said at least one mote comprises: at least one of a processor, a memory, or a communications device formed from a substrate." Thus, the Office action fails to state a *prima facie* case of anticipation with respect to claim 29. Therefore, Applicant requests withdrawal of the rejection and reconsideration and allowance of claim 29.

Applicant respectfully submits that the Office action points to no teaching, suggestion, or motivation in the cited material to combine the teachings of Mulgund *et al.*, Madden *et al.*, and Woo *et al.* as required under *In re* Sang Su Lee:

> It is improper, in determining whether a person of ordinary skill would have been led to this combination of references, simply to "[use] that which the inventor taught against its teacher." W.L. Gore v. Garlock, Inc., 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983).

Thus, assuming *arguendo* that the citations of the material set forth in the Office action teach or suggest the recitations of claim 29, the Office action still fails to state a *prima facie* case of obviousness with respect to claim 29. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 29.

As the Office action provides no support for the implication that the combination is obvious to one of ordinary skill in the art, applicant concludes that the Examiner is taking "official notice." If the Office maintains the rejection, under 37 CFR 1.104(d)(3) the Examiner must provide an affidavit or declaration setting forth specific factual statements and explanation to support the finding. Thus, if the Office maintains the rejection, in the next communication applicant respectfully requests that the Examiner provide an affidavit or declaration setting forth

specific factual statements and explanation to support the conclusion that the combination is obvious.

C. Technical Material Cited by Examiner Does Not Show Recitations of Independent Claim 13 and Dependent Claims 14-24 as Presented Herein; Notice of Allowability of Same Respectfully Requested

Independent Claim 13 and Dependent Claims 14-24 are respective "means for" versions of Independent Claim 1 and Dependent Claims 2-12. Applicant respectfully points out that, with respect to "means for" claims, MPEP § 2182, *Scope of the Search and Identification of the Prior Art*, states that with respect to patentability examination of means for claims "the *application* of a prior art *reference* to a *means* or step *plus function* limitation *requires* that the *prior art* element *perform* the *identical function specified in the claim.*"

In view of these MPEP guidelines, Applicant respectfully suggests that the art of record does not establish a *prima facie* case of the unpatentability of Independent Claim 13 and Dependent Claims 14-24 for reasons analogous to those why such art does not establish a *prima facie* case of unpatentability of Independent Claim 1 and Dependent Claims 2-12 (e.g., since the functions of Independent Claim 17 are similar to the operations of Independent Claim 1, Examiner has not established a *prima facie* case that means performing the functions of Independent Claim 13 are taught in the art; other claims are like patentable by extension). Hence, Independent Claim 13 and Dependent Claims 14-24 are patentable for at least the reasons why Independent Claim 1 and Dependent Claims 2-12 are patentable. Accordingly, Applicant respectfully requests that Examiner hold Independent Claim 13 and Dependent Claims 14-24 patentable for at least the reasons as set forth related to Independent Claim 1 and Dependent Claims 2-12, and to thus issue a Notice of Allowability of same.

IV. ARGUMENT: CLAIMS 13-24 ARE DIRECTED TOWARD STATUTORY SUBJECT MATTER

Claims 13-24 were rejected under 35 U.S.C. § 101 as being directed to non-statutory subject mater. Applicant respectfully traverses the rejection of claims 13-24.

Claim 13 recites:

> 13. A system comprising:
> means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

The Office action at page 4, paragraph 6 recites:

> As to claim 13, multi-mote reporting entity appears to be a computer program (specification, page 20, paragraph 2, lines 5-9) (for the interpretation of means plus function language please refer to ***Claim Rejections - 35 USC § 112*** section of the Office Action). A system comprising a computer program per se is not in one of the statutory categories.

Thus, in support of the rejection of claim 13, the Office action recites, "multi-mote reporting entity appears to be a computer program." However, at page 20, lines 4-5, the specification includes the recitation, "such reporting entities are computer programs that execute on processors." Assuming *arguendo* that "means for transmitting" includes a computer program, the specification clearly recites, "such reporting entities are computer programs that execute on processors." Computer programs that execute on processors have been found to be statutory subject matter on the grounds that the programs create a new computer. *In re* Alappat, 33 F.3d 1526, 31 USPQ2d 1545 (Fed.Cir. 1944) (en banc). Thus, the grounds (i.e., "multi-mote reporting entity appears to be a computer program") of the rejection set forth in the Office action" fails to support a rejection of claim 13 under 101. As the rejection includes no other grounds for the rejection, the Office action fails to establish a *prima facie* case that claim 13 is directed to non-statutory subject matter. Therefore, applicant requests withdrawal of the rejection and reconsideration and allowance of claim 13.

Further, the Office action recites, "A system comprising a computer program *per se* is not in one of the statutory categories." Applicant respectfully submits that this is not a correct statement of the law. A system "comprising" a computer program may include other recitations and therefore may constitute patentable subject matter.

In re Alappat, 33 F.3d 1526, 31 USPQ2d 1545 (Fed. Cir. 1994 (en banc), is a case on point. Independent claim 15, the claim at issue in *In re Alappat*, was a "means plus function" claim similar in structure to Applicants' "means plus function" claim 13. In response to the argument that the claimed invention of *In re Alappat* covered a general purpose computer and was therefore not patentable subject matter, the Federal Circuit stated, ". . . a general purpose computer in effect becomes a special purpose computer once it is programmed to perform particular functions pursuant to instructions from program software." The Federal Circuit further stated, ". . . a computer operating pursuant to software may represent patentable subject matter . . . ." Applicants' claim 13, like claim 15 of *In re Alappat*, is a "means plus function" claim that can convert a general purpose computer into a special purpose computer once the general purpose computer is programmed to perform the functions recited in the claims. Further, Applicants' application, at page 39, line 29-31, and page 40, lines 1-3 and page 40, lines 17-30, includes the following recitation:

> . . . those skilled in the art will recognize that some aspects of the embodiments disclosed herein, in whole or in part, can be equivalently implemented in standard integrated circuits, as one or more computer programs running on one or more computers (e.g., as one or more programs running on one or more computer systems), as one or more programs running on one or more processors (e.g., as one or more programs running on one or more microprocessors)
>
> . . .
>
> In a general sense, those skilled in the art will recognize that the various aspects described herein which can be implemented, individually and/or collectively, by a wide range of hardware, software, firmware, or any combination thereof can be viewed as being composed of various types of "electrical circuitry." Consequently, as used herein "electrical circuitry" includes, but is not limited to, electrical circuitry having at least one discrete electrical circuit, electrical circuitry having at least one integrated circuit, electrical circuitry having at least one application specific integrated circuit, electrical circuitry forming a general purpose computing device configured by a computer program (e.g., a general purpose computer configured by a computer program which at least partially carries out processes and/or devices described herein, or a microprocessor

configured by a computer program which at least partially carries out processes and/or devices described herein).

Thus, in view of *In re Alappat*, claim 13 constitutes patentable subject matter. Therefore, Applicants' request withdrawal of the rejection and reconsideration and allowance of claim 13.

Claims 14-24 are dependent on claim 13. For reasons analogous to those stated above, applicant requests withdrawal of the rejections and reconsideration and allowance of claims 14-24.

Further, applicant respectfully disagrees with the recitation, "As to claims 14-24, additional means for performing a function do not appear to introduce any tangible elements that would render a system of claim 13 statutory under 35 U.S.C. 101." For example, claim 19 recites, "means for receiving a schedule." The Office action provides no support for conclusion that "means for receiving a schedule" does not introduce a tangible element. Therefore, the Office action fails to state a *prima facie* case under 35 U.S.C. § 101. Similarly, the Office action fails to provide support for its rejections of claims 14-18 and 20-24. Therefore, Applicant requests withdrawal of the rejections and reconsideration and allowance of claims 14-24.

V. ARGUMENT: CLAIMS 13-24 UNDER 35 U.S.C. § 112, FIRST PARAGRAPH COMPLY WITH THE ENABLEMENT REQUIREMENT

The Office action, at page 5, paragraph 7, recites, "Claims 13-24 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the enablement requirement." Applicant respectfully traverses the rejections of claims 13-24.

Claim 13 recites:

> 13. A system comprising:
> means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes.

The Office action at page 5, paragraph 8, recites:

> Claim 13 appears to be a single means claim, i.e., where a means recitation does not appear in combination with another recited element of means, and is, therefore subject to an undue breadth rejection under 35 U.S.C. 112, first paragraph.

Applicant respectfully disagrees with the Office action conclusion that claim 13 exemplifies a single means claim. More specifically, claim 13 includes two "means" recitations. First, claim 13 explicitly recites, "means for transmitting . . . ." Second claim 13 implicitly recites, "means for aggregating . . . ." Thus, claim 13 includes a combination and is not subject to the single means rejection.

Claims 14-24 are dependent on claim 13. For reasons analogous to those stated above, applicant requests withdrawal of the rejections and reconsideration and allowance of claims 14-24.

Assuming *arguendo* that claim 13 is a single means claims, dependent claims 14-24, which depend from claim 13, are not single-means claims. More specifically, each of the claims 14-24 adds at least one further recitation to claim 13. Hence each of the claims 14-24

include at least two means recitations and are therefore not subject to the single means rejection of claim 12. Therefore, applicant requests withdrawal of the rejections and reconsideration and allowance of claims 14-24.

VI. ARGUMENT: CLAIMS 25 AND 28 UNDER 35 U.S.C. § 112, SECOND PARAGRAPH, ARE NOT INDEFINITE

Claims 25 and 28 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Applicant respectfully traverses the rejections of claims 25 and 28. Applicants respectfully traverse the rejections of claims 25 and 28.

Claim 25 recites:

> 25. A system comprising:
> a mote; and
> means for transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes, said means for transmitting proximate to a portion of said mote.

In support of the rejection of claim 25, the Office action at page 8 recites:

> As to claim 25, it is ambiguous because it is unclear what is being meant by "proximate to a portion of said mote". Appropriate correction or explanation is required.

The argument reduces to the claim "is ambiguous because it is unclear."

The MPEP at § 2183.02 provides:

> The examiner's focus during examination of claims for compliance with the requirement for definiteness . . . is whether the claim meets the threshold requirements of clarity and precision, not whether more suitable language or modes of expression are available.

Each of the words recited in the phrase "proximate to a portion of said mote" can be defined and interpreted by one of ordinary skill in the art. The Office action has failed to provide

an interpretation of the words in the claim. Thus, the Office action has failed establish a *prima facie* case of indefiniteness with respect to claim 25.

Claim 28 recites:

> 28. The system of Claim 26, wherein said at least one multi-mote reporting entity further comprises:
> a processor configured to transmit at least one of a sensing function, a control function, or routing/spatial information.

In support of the rejection of claim 28, the Office action at page 8 recites:

> As to claim 28, it is ambiguous because it is unclear how a multi-mote reporting entity , which is a software program, comprises a processor, which appears to be hardware component.

Although the Office action provides an interpretation of the claim language, the Office action fails to interpret in the light of the specification or explain the interpretation from the perspective of one of ordinary skill in the art. Thus, the Office action fails to establish a *prima facie* case of indefiniteness with respect to claim 28. Therefore, applicant requests withdrawal of the rejections and reconsideration and allowance of claims 25 and 28.

VII. ARGUMENT: OBJECTIONS TO CLAIMS 4, 6, 10, AND 11 ARE IMPROPER

The Office action, at page 4, states:

> Claims 4, 6, 10, and 11 are objected to because of the following informalities:
>
> As to claims 4, 6, and 10, the claim language is unclear. As claimed: transmitting . . . comprises effecting the transmitting . . . is unclear. Applicants are advised to use a proper part of speech. Appropriate correction is required.
>
> As to claim 11, the claim language is unclear. As claimed: transmitting . . . comprises encrypting utilizing . . . is unclear. Appropriate correction is required.

The Office action has provided no authority for the objection. Applicant respectfully submits that the claims do not require correction. If the Office maintains the objection in the next communication, Applicant respectfully requests that the Office action include citation to authority for the objection. If the Office cannot cite to authority, Applicant requests withdrawal of the objection.

VIII. ARGUMENT: OBJECTION TO THE ABSTRACT OF THE DISCLOSURE IS IMPROPER

The Office action, at page 3, raises an objection to the abstract of the disclosure under MPEP §608.01(b). Applicant respectfully traverses the objection to the disclosure.

Independent claim 1 recites, "A method comprising: transmitting at least a part of an aggregate of one or more mote-addressed content indexes of a first set of motes." The abstract recites, " Methods and/or systems relating to mote networks having one or more indexes." Thus, the abstract includes recitations included in the independent claims. Hence, applicant respectfully submits that the abstract permits one "to determine quickly . . . the nature and gist of the technical disclosure." Therefore, applicant requests withdrawal of the objection.

IX. ARGUMENT: OBJECTION TO THE SPECIFICATION IS IMPROPER

The Office action, at page 3, paragraph 4, raises an objection to the specification. Applicant respectfully traverses the objection to the specification.

Applicant respectfully submits that at this time the proper scope of the specification cannot be determined as the prosecution of the application is not complete. If the Office maintains this objection in the next Office action, Applicant requests that the Office action include citation to legal authority, such as citation to statutes or regulations, in support of the objection.

X. CONCLUSION

Applicant may have during the course of prosecution cancelled and/or amended one or more claims. Applicant notes that any such cancellations and/or amendments will have transpired (i) prior to issuance and (ii) in the context of the rules that govern claim interpretation during prosecution before the United States Patent and Trademark Office (USPTO). Applicant notes that the rules that govern claim interpretation during prosecution form a radically different context than the rules that govern claim interpretation subsequent to a patent issuing. Accordingly, Applicant respectfully submits that any cancellations and/or amendments during the course of prosecution should be held to be tangential to and/or unrelated to patentability in the event that such cancellations and/or amendments are viewed in a post-issuance context under post-issuance claim interpretation rules.

Insofar as that the Applicant may have during the course of prosecution cancelled/amended claims sufficient to obtain a Notice of Allowability of all claims pending, Applicant may not have during the course of prosecution explicitly addressed all rejections and/or statements in Examiner's Office Action. The fact that rejections and/or statements may not be explicitly addressed during the course of prosecution should NOT be taken as an admission of any sort, and Applicant hereby reserves any and all rights to contest such rejections

and/or statements at a later time. Specifically, no waiver (legal, factual, or otherwise), implicit or explicit, is hereby intended (e.g., with respect to any facts of which Examiner took Official Notice, and/or for which Examiner has supplied no objective showing, Applicant hereby contests those facts and requests express documentary proof of such facts at such time at which such facts may become relevant). For example, although not expressly set forth during the course of prosecution, Applicant continues to assert all points of (e.g. caused by, resulting from, responsive to, etc.) any previous Office Action, and no waiver (legal, factual, or otherwise), implicit or explicit, is hereby intended. Specifically, insofar as that Applicant does not consider the cancelled/unamended claims to be unpatentable, Applicant hereby gives notice that it may intend to file and/or has filed a continuing application in order prosecute such cancelled/unamended claims.

While particular aspects of the present subject matter described herein have been shown and described, it will be apparent to those skilled in the art that, based upon the teachings herein, changes and modifications may be made without departing from the subject matter described herein and its broader aspects and, therefore, the appended claims are to encompass within their scope all such changes and modifications as are within the true spirit and scope of the subject matter described herein. Furthermore, in those instances where a convention analogous to "at least one of A, B, and C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., " a system having at least one of A, B, and C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). In those instances where a convention analogous to "at least one of A, B, or C, etc." is used, in general such a construction is intended in the sense one having skill in the art would understand the convention (e.g., " a system having at least one of A, B, or C" would include but not be limited to systems that have A alone, B alone, C alone, A and B together, A and C together, B and C together, and/or A, B, and C together, etc.). It will be further understood by those within the art that virtually any disjunctive word and/or phrase presenting two or more alternative terms, whether in the description, claims, or drawings, should be understood to contemplate the possibilities of including one of the terms, either of the terms, or both terms. For example, the phrase "A or B" will be understood to include the possibilities of "A" or "B" or "A and B."

With respect to any cancelled claims, such cancelled claims were and continue to be a

part of the original and/or present patent application(s). Applicant hereby reserves all rights to present any cancelled claim or claims for examination at a later time in this or another application. Applicant hereby gives public notice that any cancelled claims are still to be considered as present in all related patent application(s) (e.g. the original and/or present patent application) for all appropriate purposes (e.g., written description and/or enablement). Applicant does NOT intend to dedicate the subject matter of any cancelled claims to the public.

The Examiner is encouraged to contact the undersigned by telephone at (952) 876-4093 to discuss the above and any other distinctions between the claims and the applied references, if desired. Also, if the Examiner notes any informalities in the claims, he is encouraged to contact the undersigned to expediently correct such informalities.

Respectfully submitted,

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DJP

Enclosures:
- Postcard
- Check
- Petition for Extension of Time
- Post-Filing Transmittal

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